

Is Meat Good or Bad?

Learn What Modern Science Has
to Say About Animal Products



Is Meat Good or Bad?

A Holistic Approach to Health

Table of Contents

Preface.....	1
Dying Without Warning.....	2
Are You a Victim of Headline Science?.....	3
Does Red Meat Kill You?.....	6
The Big Picture.....	6
Specifics.....	12
Chicken: Finger Licking Good (Plus Cancer).....	22
Not a Safe Alternative to Red Meat.....	22
Chicken = Penis Cancer?.....	23
Fish Is a Sponge of Toxic Waste.....	25
The Terrible Edible Egg.....	28
Dairy (Far Worse than You Think).....	32
The Final Arguments.....	35
What Should I Eat?.....	37
And, No, Salt Is Not Good for You.....	51
The Evidence.....	53
The Counterarguments.....	58
What Should You Do About Salt?.....	69
Iodine.....	74
You're Wrong About Working Out.....	92
You're Still Wrong About Working Out.....	107
Teeth: A Critical Issue (aka Sugar Is Also Bad for You).....	113
Have You Been Ignoring Your Teeth?.....	114
Cane Sugar, Brown Sugar, Molasses, and Honey.....	116
A Whole-Food, Plant-Based Diet Versus Cavities.....	119
But Be Careful With Fruits, Especially Apples and Oranges.....	122
And Eat Less Frequently.....	125
Remineralizing Teeth With Tea, Herbs, And... Sugar?.....	125
Can We Make a Better Toothpaste?.....	133
Dentists, Should We Still Visit Them?.....	141
What About Your Gums?.....	145
Conclusion.....	146
Teeth: A Critical Issue (Part 2).....	147
Teeth: A Critical Issue (Part 3).....	156
EMF.....	160
The Internet.....	162
The Gut Microbiome.....	163

The Four Pillars of Health.....	166
Surprise! Meat is Good for You! (What?!?).....	168
Guides.....	178
Food Guide.....	179
Shopping Guide.....	180
To-Do List.....	181
Supplement Guide.....	182
Further Reading.....	183
Acknowledgments.....	184
References.....	185

Copyright © 2014, 2017, 2021, 2022, 2023 - Tom H. Aiken

Though copyrighted, you are free to make copies of the book or its various pages for non-commercial uses (e.g., giving them to your friends and family).

Always consult with your doctor before changing your diet or exercise routine.

Preface

I hesitated for a bit to give this special acknowledgment at the front of the book as if you're familiar with his work, it reveals the answer to the title of the book (but so will reading the table of contents). I wanted the answer to be a gradual one emerging from solid scientific evidence and critical thinking. But I know it is the right thing to do.

This book stands on the shoulders of another man's work. When I wrote the original book I wanted it to be the shortest and most concise reading material possible that still answered the question once and for all. While I did my own research, I needed the best evidence out there to convince people, so I had to use this person's material. The vast majority of the studies as well as many arguments used in the original book (the first half of the current book) and a good number of the studies (and I probably used some of his arguments there as well) from the new chapter (the last half of the book) comes from Dr. Michael Greger's lifework so far. I say "so far" as he's still working hard researching and creating new material. He also has a team of volunteers who I'm certain deserve praise for their hard work as well. So thank you Dr. Greger and team for everything you do in the name of health science and for the good of the public.

This book was written independently and without the knowledge of anyone mentioned within. As such, any errors found in this book are mine and mine alone.

Finally, this last version of the book should always be free. It's copyrighted, but you may make as many copies as you want to give to others.

Enjoy!

Dying Without Warning

I couldn't believe the news. The father of one of my friends died. And he was only in his early 50s.

The guy wasn't a health nut, but he never had any serious health issues and he definitely made time for the gym. And at that gym, he played a game of basketball with his son. After, he said he overdid it and had to sit down only to die of a massive heart attack moments later in the arms of his son.

When they opened him up, his arteries were clogged with plaque.

It is a pretty scary concept, to have a heart attack that kills you without warning.

And with coronary heart disease (narrowing of the arteries to the heart from plaque) being the number one killer for men and women in America and the world, it is way more common than you think.

Not an issue for me, I exercise regularly and eat healthy.

Exercise may not be enough. We are seeing presumably fit people dying. And the "healthy" diet you are consuming may be the reason you will have a heart attack one day.

You could be jogging one moment, only to be dead the next.

But there is an explanation for everything. And using science, we can explain and prevent heart disease. So let's crack open this book and find out how not to be a victim of a heart attack.

Are You a Victim of Headline Science?

Headline science, the most popular science of all time.

Why read an article when you can just read the headline?

Like this one from *The New York Times*:

"Eating Vegetables Doesn't Stop Cancer"

Thanks headline science! I'll make sure all my friends know this amazing fact.

And this one:

"Fruits and Vegetables Do More to Reduce Cancer and Extend Life than Many Prescription Drugs"

Wait... I thought vegetables do nothing against cancer (trust me, they do). How do you know which one is telling the truth?

I guess you'll have to read the articles, the studies they cite, do a bit of research yourself, and do some critical thinking of your own.

(Turns out that the study *The New York Times* cited did find an inverse relationship between fruit and vegetable consumption and cancer (i.e., vegetables prevent cancer), but it was smaller than expected. So to say eating your vegetables will not help stop cancer is twisting the truth. But, hey, anything to sell papers.)

Let's talk at a high level how scientists do their research to better understand things.

It doesn't always follow this format, but this is how it usually works.

First, there are the *observational* studies.

You are viewing the world around you and trying to find correlations. So something like a survey would be an observational study. And maybe an observation in a survey finds vegetable consumption coincides with better athletic performance in a population.

Once they find correlations, they then see if there is causation.

This is where *experimental* studies come in.

They create controlled experiments to recreate and explain the link. Health scientists can do this by conducting a trial with people (e.g., have a group of people increase vegetable consumption and a control group that doesn't). After that, they'll try to recreate the chemical reactions happening in the body in a laboratory to completely understand what is going on.

But those molecular studies explain *why* something happens in our bodies. The experimental studies, however, show that it *does* happen, which makes them the most important. While the observational studies show that something *might* be happening inside our bodies, which is why observational studies are never enough.

(Technically, molecular studies can be experimental or observational in nature, but let's not get too bogged down with the details here.)

Of course, one experimental study isn't ever enough. So you want several and you want to vary them so you can narrow down what is happening.

You can get more specific by using only certain vegetables, having participants do only certain exercises to test athletic performance, etc. You get more narrow until you can explain your observations.

And when we do that we find out great things about our health like beet consumption being an amazing booster to athletic performance.[1],[2]

But when you only start and end with an observational study, that is just bad science. But the unethical media loves bad science to stir up controversy and attract readers.

And if people only read the headline, they'll never know if it is bad science or not.

Like this one:

"Vegetarians Less Healthy, Lower Quality Of Life Than Meat-Eaters"

But if you look at the study (a telephone survey in Australia), the author said there was no known causation between being a vegetarian and a lower-quality or less healthy life. There is a correlation, but, as the author notes, that correlation could be explained by the fact unhealthy and depressed people turned to a vegan or vegetarian lifestyle hoping to feel better. But they weren't for sure. Why? Because this was an *observational* study. We need to follow up with experimental studies.

But putting the truth in a headline that doesn't shock people won't get readers.

Could you imagine:

"Small Phone Survey Showed Some Vegetarians Do Have a Lower Quality of Life and Health (Might be Due to Unhealthy and Depressed People Trying the Lifestyle for the First Time to Help Themselves). Follow Up Studies Needed."

No magazine would run that.

Fine, but don't let yourself fall victim to headline science. Read and be critical.

The same goes with this book. Read it all, check the studies I cite, compare what I say with contradictory evidence and other written material, and then make up your mind.

I hope you enjoy the book!

Does Red Meat Kill You?

Ah, the most evil of all animal products—especially when processed. Or is it?

Well, if you believe what the government and what a lot of research institutions say, then red meat is clearly bad for you. However, people advocating a diet based on meat and animal products argue that the government and those institutions have no idea what they are talking about.

When answering health questions, it is best to look very broadly at the evidence and then narrow our focus to explain the observations. But in both situations, you always want to look at the science.

So let's take a 10,000-foot view with a 100,000+ participant study.

The Big Picture

In 2012, a group of Harvard researchers published a study showing red meat consumption shortened your life. A group of 121,342 participants were followed for about 30 years. It concluded that not only did it shorten your life but it also caused other health problems (like cardiovascular disease and colorectal cancer).[3] Harvard has even said that "healthy meat consumption" is clearly an oxymoron.

So how much red meat was needed to impact mortality? About 3 ounces a day, roughly the size of a deck of cards. Keep in mind, that was *unprocessed* red meat. Of course, processed red meat was even worse.

But that's just one study!

True. But instead of telling you, again, it was over 100,000 people, over 30 years of data, and it was done by Harvard (I doubt they would drop the ball on this one), I'll refer to a bigger study.

How about the EPIC study with over 500,000 participants (448,568 by the end of the study).[4]

What did they find?

Red meat consumption is linked to a higher mortality rate.

Wait, the conclusion said only processed meat had a link!

Okay, let's back up here. I'll give you the exact quote.

"After multivariate adjustment, a high consumption of red meat was related to higher all-cause mortality, and the association was stronger for processed meat."

Multivariate adjustment means they controlled for factors that might throw off the conclusion (like their age, whether they smoked or not, family history of death, etc.). So we have the same results as the Harvard study.

Red meat consumption is clearly linked even when you adjust for other factors.

Why does the conclusion not say that?

They also did what they called a "measurement error correction."

But here is the thing, they didn't correct for any known errors. They randomly sampled a small percentage of the survey and asked them to do a 24-hour recall of food they ate. In other words, they asked them to remember what they ate the previous day. And 24-hour recalls have been proven to not be very accurate at times. They should have monitored their food consumption instead.

In theory, the results from the smaller sample size group should be more accurate than the survey, but even then it doesn't fairly represent the errors made by the 500,000 as a whole. The errors made by the 500,000 might have been, overall, the exact opposite (e.g., the smaller sample group reported more meat consumption on the survey than they actually ate, while the 500,000, as a whole, reported less meat consumption than they actually ate.)

That does seem a little odd. But they're the scientist, I'm sure they know what they're doing here.

Keep in mind, in this massive study there were about 40 organizations that contributed financially and about 50 authors. While the study claimed no competing interest, it is pretty common to have these organization and authors be paid by different industries (maybe not for this one study but other studies authors have done in the past, other studies they hope to be funded in the future, and for donations that some of these organizations would want to receive in the future), which include ones like the dairy, the pork, and the beef industry, while not mentioning it. So there is often pressure to soften the blow on findings that look bad for their financial contributors or for potential financial contributors.

But the main problem here is this is an observational study. You want to find correlations to follow up on with experimental studies. You do not want to get rid of them. And, clearly, there is a correlation between red meat and mortality.

I don't know. Sounds like you are trying to find correlations that might not be there.

Okay, how about another study with another 500,000 people? The NIH-AARP study.

What did they find? The same thing. Both red meat and processed meat increased total mortality, cancer mortality, and cardiovascular disease mortality.[5]

Now we have three separate studies with sample sizes ranging from 100,000 to 500,000 people showing a link between red meat and increased mortality and disease.

Yeah, but isn't that because they are eating grain-fed, hormone injected meat? Grass-fed, red meat from wild animals might not have those problems.

The experimental studies, the only studies we really care about, show no difference between those types of red meat. I'll get into it later, but we

have studies showing how even these "clean" sources of meat create essentially the same health problems.

For now, let's get into the specifics why red meat is bad for you.

Wait! I have a study with over 1,000,000 people showing no unhealthy link to red meat! Just processed! [6]

Like I said those big studies are there to just help us decide what to investigate. We shouldn't take them as fact or by themselves as good science.

But, okay, let's look at that study. It was a review study. In other words, they looked at different studies and drew their conclusions from there.

Out of 1,500 studies to review, they picked 20. Keep in mind, 17 of the 20 studies reviewed were observational studies. Because of the number of factors we don't know about or cannot control in observational studies, we expect them to not always agree with each other.

And they only looked at stroke, coronary heart disease, and diabetes, not cancer or mortality rates. I never made an argument about diabetes so let's put that to the side. We'll look at your study in regard to showing no link with red meat to stroke or coronary heart disease.

Let's make sure we are on the same page here. Arterial plaque is the only cause of coronary heart disease (our number one killer in the world) and virtually the only cause of heart attacks. Arterial plaque is also the primary, but not only, cause of stroke (our second most common killer). Let's look at stroke first.

Of those 20 studies, only 3 looked at the association between stroke and red meat consumption. That would make the sample size much smaller than 1,000,000 people. And all 3 were observational studies.

Let's take a closer look at those three studies.

The first one was done in Japan looking at people who were exposed to atomic bomb radiation. Not exactly the best sample population. And the institute that did the study is focused on caring for radiation exposure

victims, not dietary health. Finally, animal consumption was *not* associated with preventing strokes caused by blocked arteries (which accounts for about 85% of strokes). It only *appears* protective against Hemorrhagic Stroke (which occurs when a weakened blood vessel ruptures and accounts for about 13% of strokes).

The second study was *against* red meat consumption, "These data suggest that a dietary pattern typified by higher intakes of red and processed meats, refined grains, and sweets and desserts may increase stroke risk, whereas a diet higher in fruits and vegetables, fish, and whole grains may protect against stroke."

The third study looked at middle-aged men in the United States. The problem with this study has to do with the fact that once you are in that age range a lot of damage to your body has already been done (things like calcification of atherosclerosis plaque happens more in older people and takes longer to treat). In other words, if they started to increase or decrease red meat consumption, it may not make much of a difference right away (at least not during the length of the study). This is the "sick population" argument (an important concept to understand in health science), which I'll talk more about later.[7]

So what about the Japanese study you mentioned that showed animal products were protective against Hemorrhagic Stroke - the cause of 13% of strokes?

So is red meat and/or saturated fat protective against strokes? Overall, most likely not (I'll talk more about this in detail). However, I think it is the B12 in red meat that is showing the protective or neutral effect with this one type of stroke. B12 protects arteries from homocysteine toxins, which could explain the inverse relationship found.[8]

But that you can supplement for cheap. (B12 is one of the cheapest supplements you can buy.)

(For those of you who don't know, B12 is made by bacteria. And those bacteria are mostly found in your colon. But your colon can't absorb the B12 already in it so it has to find a way from your anus to your mouth—gross. Certain animals are ruminants, like cows, that can absorb the B12

they produced due to their unique digestive tract. But all other farm animals, like pigs, have B12 because they live in such filthy environments—their feces eventually get in their mouths—or because of supplementation. If you're wondering how we used to get B12 without farm animals or how the rest of the world gets it, one reason is that they eat bugs, which are full of B12. Even the Bible talks about what bugs people ate back in the day. And since everything was filthier back then with feces and dirt (the bacteria that makes the B12 in your gut came from the dirt), everything they ate, especially from nature, probably had a ton of B12 in it. But eating from nature can also get you sick with other bacteria, so it's probably best to just supplement.)

But why get B12 from an unhealthy source? Would you drink a healthy green smoothie that is laced with poison? Eating red meat for B12 doesn't make any sense. And even omnivores (meat and plant eaters) have been shown to be deficient. So supplementation is best for everyone.

But what about the findings on coronary heart disease?

The analysis of coronary heart disease included 4 studies when it came to red meat. So in regard to coronary heart disease, the study size is also much smaller. 3 of them were observational and 1 was experimental. The experimental study (again, the only studies we really care about) *did* find that red meat causes coronary heart disease.

For the three observational studies, I think the "sick population" argument, which, again, I'll talk about later in the specifics section, easily explains the inconsistencies between observational studies. And before you say we don't have a sick population, keep in mind coronary heart disease is the leading cause of death not just in the United States but in the world.

Furthermore, with observational studies, it's easy to present the data or create surveys that are confusing for both the readers and the people participating in the studies. And when you consider that many authors are paid by certain industries hoping for certain findings, you can see the problem with observational studies.

Finally, the study you found was done by a Harvard professor some time ago. Yet, Harvard's stance is still to avoid red meat. If that study had more merit, don't you think Harvard would have changed their position?

Remember, you expect to see inconsistencies between observational studies. There are just too many variables to control for. But you don't end your discussion using observational studies. You go on to the experimental studies. And that is what we are about to do.

So when you look at all the observational studies as a whole, clearly there is a link between red meat consumption, disease, and mortality. Now let's see what is causing that link.

Specifics

Cancer

Let's start with cancer.

Does red meat cause cancer?

Looking at the Harvard study again, red meat has been linked to colorectal cancer, but how?

According to the American Institute for Cancer Research, heme iron (what makes red meat red) damages the lining of the colon.

But my trainer says that is the best kind of iron!

First, you have to understand that iron is both good and bad for us. We need it to make red blood cells to carry oxygen, but it also causes oxidative stress. And oxidative stress damages your body.

This heme iron is a type of iron your body can't regulate. Since it is already wrapped in hemoglobin, it can easily pass through your colon and then into your blood. Trainers and meat advocates call it high absorbing, but not really. Your body simply can't keep it out of your system. Forced

absorbing would be a better term. Even if you are at toxic levels, your body has no way to keep heme iron out of your system.

Plant-based iron (non-heme iron) *is* regulated by your body. If your body needs more, it absorbs more. If your body doesn't need as much, it absorbs less.

While non-heme iron has several systems to regulate it, heme iron appears to hijack the protein system used by your body to move your own hemoglobin and oxygen around and force itself into your colon cells and blood. While heme absorption is dependent on the presence of these hemoglobin related proteins and the levels of these proteins probably have something to do with your need for oxygen/hemoglobin, you could argue that there is *some* regulation (though I use that word very loosely here) of heme iron absorption. But it's nothing compared to the regulation of iron found in plants.[9][10]

But keep in mind, we *need* tight regulation of our iron levels. Why? Because our bodies have no good way to get rid of the excess. While woman can get rid of some through their periods, neither gender really evolved anything to get rid of excess iron in our bodies. Given iron's pro-oxidant effect, this might explain why donating blood as little as twice a year is linked to a decrease in cancer and mortality rates.[11]

Given that information, I would advise you to donate blood when you can. Not only could you save someone's life but you might just save your own.

So the heme iron found in red meat and the oxidative damage it does to your cells might explain this link to cancer.

Look! I found a study showing red meat does not cause colon cancer![12]

First, they never said red meat doesn't cause colon cancer. They said, in their opinion, that there were so many factors you cannot definitely pin it on red meat. I disagree with their opinion, but I'll return to that later. For now, let's look at who did the study.

One of the authors, Alexander, works at a for-profit corporation (Exponent, Inc.) traded on NASDAQ. They are a consulting firm for

different industries. You typically see them refuting evidence made by the media when it makes a company look bad (e.g., Dateline's report on the explosiveness of Chevrolet's fuel tanks and Consumer Report's findings on Suzuki's roll-over safety).

I'm not saying the author had an alternative motive, but it certainly does raise a red flag. (In my personal experience working at a firm that consulted for different companies, we were as aggressive as possible to please our clients.)

Furthermore, this summary review only looked at observational studies, not experimental studies (are you starting to see a trend here with these pro-meat studies?). The problem with observational studies agrees with their conclusion: you can only show *potential* factors as there are too many factors present in any group you study to give a definite answer.

(Please note, people who do these studies understand this and try to account for it by researching alternative explanations and by using mathematical models to control for disruptive influences. But still, you can only get to *potential* factors.)

But let's do a better job than summarizing some observational studies. Let's look at some meta-analysis studies (review studies that look at *all* the studies done on a topic). Not just one meta-analysis, but three, all done by different authors and independent of each other. What did they find? All of them showed eating red meat caused a 20-30% increased chance of getting colon cancer.[13] Keep in mind, they only used studies they considered high quality (i.e., ones that best controlled for other potential factors). So, without a doubt, red meat consumption is a potential factor in causing colon cancer.

(If you want to know more about meta-analysis studies, they find all the studies on a given topic and apply statistics to determine which ones to look at closer and which ones to give more weight to when calculating everything.)

Now, let's look at the experimental data. The experimental and molecular studies clearly show that red meat causes colon cancer.[14] It all goes back to the heme iron. The heme iron creates free radicals (hydroxyl

radicals, which are extremely strong) that are genotoxic (causes DNA damage) to your colon. The heme iron also creates fat peroxidation, which produces chemicals that aren't just genotoxic, but also appear to promote the growth of tumors in the colon. It is even worse with cured (processed) meat as the heme iron also creates N-nitroso compounds (also genotoxic).

There you have it. The experimental studies perfectly explain our observational findings: red meat causes colon cancer and processed red meat is even worse.

Both the observational data and the experimental data support the fact that red meat is clearly a significant cause of colorectal cancer.

And it doesn't matter if it is grass-fed, that "superior" meat still has heme iron in it.

Now there are also other ingredients in meat that, in general, seem to have a pro-cancer effect (e.g., Neu5Gc, PhIP, polycyclic, aromatic hydrocarbons, L-carnitine, leucine, advanced glycation end products, and arachidonic acid) by either feeding cancer cells, causing DNA damage, causing inflammation, and/or accelerating the aging process.

I'll talk more about some of these later on, but keep in mind red meat either has these ingredients or creates them during the cooking process (and, again, it doesn't matter if it is grass-fed or not).

Between heme iron and all these other ingredients, it is no wonder that we have a clear link between red meat consumption and cancer.

Cardiovascular Disease

On to the next subject and back to getting strokes and coronary heart disease.

The problem probably has to do with all the saturated fat in red meat (which is also found in just about all animal products) producing atherosclerosis plaque in our arteries.

But people keep telling me saturated fat is good for you!

Let's talk about the heart surgeon Doctor Esselstyn to answer that. On a mission to stop coronary heart disease, he started advising patients on what to eat. And by using MRI scans on them, he showed that a diet that is free of animal products (saturated fat) and low-fat in general would open up the arteries. The MRI scans show the arteries going from being barely open to completely dilated.

I don't know what else is more convincing than that. You can literally see the arteries opening up once you remove saturated fat from the diet (FYI, with the exception of coconuts, a few nuts, and the microscopic amounts in other plant foods, saturated fats only come from animal sources).

What about the Masai? They eat almost nothing but animal products and they show no sign of heart disease.

But the Masai tribe of Africa burns calories like elite athletes. They don't have jobs where they sit around all day. They never stop moving.

(Saturated fat is an energy source. And that molecule is broken down, specifically to water and carbon dioxide, when it is converted to energy. And that's why exercise will work to get rid of body fat. Unfortunately, it takes a lot of exercising to get rid of a decent amount of fat. You're better off just restricting the calories you eat. And saturated fat, which pretty much only comes from animal products, is the most calorically dense macronutrient out there.)

And, still, a study done of their bodies (autopsy examinations) clearly showed that their arteries are caked with atherosclerosis plaque (equivalent to that of an old man raised on a Western diet).[15] Keep in mind, their meats are not processed and their animals are fed off the natural vegetation found in the area. So grain-fed meat isn't the problem here. Their constant activity is what probably keeps coronary heart disease at bay (barely). Working out all day long isn't an option for most people.

And other studies show even if you work out like a marathon runner, a person eating a diet free of animal products (vegan), without the crazy exercise, will still have less atherosclerosis plaque.[16]

Besides the Masai, if you look at different preagricultural, hunter-gatherer tribes and ancient civilizations, they also suffered from atherosclerosis. [17]

I'll take it one step further. Compare the Masai people in Africa to the Bantu people in Africa who eat mostly a vegan diet. Their autopsy reports showed only one *potential* case of coronary heart disease in 1,328 bodies examined.[18] That means the Bantu have clean, healthy arteries.

And it isn't limited to the Bantu. For all cultures who rely solely on or almost solely on plant foods to obtain their nutrition, heart disease becomes virtually nonexistent (like the poor class in India[19] and China[20] before the Western diet was introduced). But once the food changes to a meat-based diet, heart disease starts to show up.

We see that plaque, by looking at autopsies, comes in once their diet changes. And the *only* thing that causes coronary heart disease is the buildup of atherosclerosis plaque. And, remember, coronary heart disease is the number one killer in the world.[21]

I think why you see such a clear difference between the Masai and Bantu, and not in all observational studies, has to do with the "sick population" argument. Basically, if you have a population already eating a lot of red meat and possessing thick layers of plaque in their arteries from decades of bad diet, you may not see much of a difference when you add some more or reduce meat consumption for a few months as these people are already "sick" with arterial plaque. And arterial plaque doesn't disappear overnight. Dr. Esselstyn's MRI scans of arteries opening up were over a period of 3 to 5 years (though the benefits and reduction of plaque certainly happen sooner than that, there's probably still enough plaque there to rupture, cause a blood clot, and thus a heart attack) and that was with a very low-fat, vegan diet. Plus, some studies might have people reduce animal products and saturated fat, but then they end up eating more processed foods and trans fat (hydrogenated plant oils that are as

bad or worse than saturated fat when it comes to heart disease). Processed foods aren't as much of a factor when comparing the Masai to the Bantu.

There has been a number of systematic reviews (reviews of only high-quality studies) and meta-analysis studies done between 1994 and 2014 (20 years) looking at saturated fat and the findings of the studies were, overall, that reducing or replacing saturated fats with plant-based fats (that *aren't* hydrogenated and especially when in their whole food form like nuts) leads to a decrease in cardiovascular disease.

But people are quick to point out just one of those studies from 2014 in the Annals of Internal Medicine showing no link. And the media makes sure to create those sensational headlines with it (more headline science).

The problem with the 2014 study has to do with how each person is different. Every person has a natural cholesterol set point. Yours might naturally be at 170 while another person's is naturally at 130. While we know through the experimental studies that eating less saturated fat means lower cholesterol levels and more saturated fat means higher cholesterol levels, comparing one person's cholesterol levels to another person's levels, especially in an observational study, would make it much harder to draw that conclusion. But that's what a cross-sectional study does. And guess what kind of studies were used in the 2014 meta-analysis study? Cross-sectional. Not only that, but the 2014 study was essentially a rehash of a 2010 meta-analysis study done by a man who is funded by the dairy and beef industry. It seems like the study was designed to be bad science from the beginning to confuse the public.

Furthermore, the 2014 Annals of Internal Medicine study has been criticized for having errors, omissions of key studies, and failing to mention how they picked their studies for review. No wonder Harvard came out and said that the study was "seriously misleading and should be disregarded."

The experimental studies (not just the *good* observational studies), specifically controlled trials where they lock people up and control what

they eat, support the fact that saturated fat increases plaque in your arteries.[22] In general, lipids (e.g., fats) are carried to arteries by the protein LDL and the protein HDL removes the lipids from the arteries. And it has been shown that overall with experimental studies, saturated fats increase the amount of LDL in your blood while monounsaturated and polyunsaturated fats increase HDL.

When you look at the weight of the evidence (Dr. Esselstyn's work and MRI scans, the Masai and Bantu people, ancient hunter-gatherer civilizations, compare marathon runners to sedentary vegans, and the best meta-analysis studies done) there is no doubt animal products contribute a great deal of plaque to your artery walls.

Most likely it is the saturated fat. But even if it is somehow not the saturated fat, a diet based on animal products (including red meat) clearly adds plaque to your arteries. Period.

But it gets even worse with red meat.

There is a chemical called Neu5Gc that primates (like us) lost the ability to make. This is most likely a good thing as it is believed to cause chronic inflammation due to an antibody reaction which might feed tumors and cause atherosclerosis.[23],[24]

The science on Neu5Gc is in its infancy, but the link seems very strong.

Furthermore, our diet containing Neu5Gc from eating other mammals (e.g., red meat) might explain why humans get rheumatoid arthritis, while our primate cousins do not. And it would also explain why arthritis sufferers feel better when meat is removed from the diet.

But, hey, if you want to be like the several meat-based diet advocates who have died of a heart attack (I won't name names out of respect for their families), then go ahead and eat meat. These diet gurus are dying in their 50s!

And exercise is generally not enough to prevent heart attack (unless you are working out like the Masai). The man who was accredited with starting America's fitness and jogging revolution died at age 52 of a heart

attack. He thought diet wasn't nearly as important as exercising consistently. When they opened him up, he had 70-95% blockage of major coronary arteries. Exactly what Dr. Esselstyn would see time and time again during his open heart surgeries.

Now compare those heart attack victims to Doctor Ancel Keys. He was the original advocate of replacing animal fats with plant fats and having a low-fat diet (the guy many Paleo/Primal advocates say screwed up the public with "bad health information"). Do you know how old he was when he died? He was over 100. And what about his wife who co-authored his books and also did his diet? 97.

Who do you want to be?

Inflammation

I know people tend to think that meat, especially red meat, is needed to build strength, to be muscular, and to have high testosterone levels. It's not. In fact, many male vegans (people who don't eat animal products) report higher testosterone levels than men who eat meat (it's probably due to vegan bodies working at their optimum since saturated fat isn't clogging everything). Another misconception is that inflammation is good for building our bodies. But, in general, inflammation should be avoided as in the long-term it will damage and age us.

And animal products have always been associated with inflammation, but the science explaining it is pretty new.

The big cause of inflammation seems to be dead bacteria in animal products (including unspoiled products) when you eat them. Doesn't matter if you cook it to a crisp or expose it to acid (like your stomach), the dead bacteria are still there. And they get absorbed with the fat in your food into your blood. Then your immune system detects the dead bacteria, reacts to it as if it was alive, and starts the inflammation process throughout your body. And that process can last for hours.[25]

What about bacteria found on plant food?

Well, typically, those are the bacteria naturally found in our guts (that's where they came from). So they are usually good bacteria (and microbes can rarely attack both plants and animals), thus our immune system shouldn't see them as a threat.

What about E. coli?

E. coli comes from fecal matter. Any plants containing *E. coli* were probably cross-contaminated with animal waste.

So think about it, when you include meat in every meal your body is in a constant state of inflammation throughout the day. When you consider that continuous inflammation is linked to organ failure, joint damage, and maybe all forms of chronic disease, that isn't a good thing.[26]

...but my meat is grass-fed.

Again, this does not matter. Grass-fed or not, it still has the same dead bacteria and thus still causes inflammation in our bodies. There is even a study that shows wild, grass-fed animal meat causes inflammation in our bodies once we consume it.[27]

And don't forget about Neu5Gc. Since Neu5Gc has only been found in mammals, up to this point, red meat should cause even more inflammation than other animal products.

The bottom line is all meat equals inflammation.

Chicken: Finger Licking Good (Plus Cancer)

Certainly, low-fat, white meat is a safe alternative.

Nope, I would even say it is worse.

Let's see why chicken is so bad.

Not a Safe Alternative to Red Meat

As you probably already know, over-cooking meat (especially at high temperatures) can create body-damaging, cancer-causing chemicals to form. One of these is called advanced glycation end products (AGEs) known for its highly oxidative damage to cells and is believed to contribute to the aging process. After testing 500+ foods, do you know which one came out with the most AGEs per serving? BBQ Chicken.[28]

But it isn't just AGEs that are formed with chicken.

Heterocyclic amines (HCAs) are carcinogens that are usually formed only when meat is cooked at a high temperature (like pan frying or barbecuing). However, chicken has been shown to create these HCAs including PhIP (a very dangerous HCA when it comes to breast cancer) at even low temperatures.[29]

Keep in mind, these chemicals created from cooking have been linked to kidney cancer, colon cancer, lung cancer, and pancreatic cancer (a cancer that is rapidly fatal in most cases).

And virtually all animal products can form these chemicals when cooked. Just more reason to stay away from animal products altogether.

(When you pick your poison, HCAs are found in higher amounts in meats that are cooked at higher temperatures or cooked well done. However,

the less you cook your meat the more you risk *E. coli* and parasitic infection. Again, your best option is to just stay away from it all together.)

And speaking of pancreatic cancer, the NIH-AARP study showed a link between animal fat and pancreatic cancer, but no association with plant fats.

Furthermore, two other studies showed an association between pancreatic cancer and animal protein and animal sugar (lactose, which is only found in milk). Just another reason to stay away from all animal products.[30],[31]

But I digress. Back to chicken!

It has been found out that many cancers are methionine dependent (methionine is an amino acid). In other words, without that amino acid they would die. If you want to restrict methionine in your diet, stay away from animal products. They contain far more methionine than plant foods. However, chicken, turkey, egg whites, and fish vastly beat out all other animal products for methionine levels.[32]

And in a random sample of chicken at grocery stores, one study showed over half of the purchased chicken meat contained unnaturally high levels of inorganic, cancer-causing arsenic (probably due to the arsenic-based feed additives and drugs used on the chickens).[33]

Chicken has way too many harmful chemicals in it.

Chicken = Penis Cancer?

So here is another interesting thing about chicken, it has quite a bit of viruses that are harmful to humans.

These viruses seem to promote cancer in the human body. And this might explain why chicken is linked to blood cancer (lymphoma).[34]

And high cancer rates (including penis cancer) were found with those who worked with chicken.[35] My guess is they handled one kind of chicken all day to then handle another kind later that night.

Keep in mind, they take measures to protect themselves, as required by law and company policy, like sanitizing their tools, equipment, and workline; washing their hands before and after work and their breaks; and wearing industrial rubber gloves that can run up to their elbows over or taped to their disposable jackets. And how much safety do you exercise when you handle raw meat at home?

Chicken isn't just linked to penis cancer, but also to the development of a smaller penis.

Phthalates, especially MEHP, are linked to reduced penis size if it was in the blood of the mother while pregnant.[36] What animal food has the highest level of MEHP? Poultry and eggs.[37]

Besides cancer, poultry workers suffer more from thyroid conditions, schizophrenia, autoimmune neurological disorders, peritonitis, and disease of the kidneys.[38] Again, this is probably due to the microbes that can harm both humans and chickens.

Speaking of microbes, another study showed that about half of all chickens purchased at a grocery store contained *staph* (*Staphylococcus*) bacteria. Turkey was even worst.[39] And *staph* contaminated foods are one of the leading causes of food poisoning resulting in vomiting and diarrhea.

Do you really want to put that stuff in your mouth?

Fish Is a Sponge of Toxic Waste

But fish is still good for you, right?

There are probably more chemicals in sea life than any other animal product.

Mercury is still an issue with fish.

And mercury usually takes about one year for the current levels in your body to drop to about 1%. That is the good news. The bad news is other toxic chemicals in fish (dioxins, PCB, and DDE) can take up to 60 years for your body to lower its levels to 1% (based off a 10-year half-life).[40]

(A little more information about the chemicals I just mentioned. They are man-made chemicals created by or used in the manufacturing process or are pesticides we developed. While banned, nature has a hard time breaking them down and, thus, the reason they are still a problem today. They were often leaked into different bodies of water which caused fish and anything that eats fish to contain these chemicals.)

Fish also seem to be the primary source of the obesogen, organotin (endocrine disrupting compounds made of tin and hydrocarbons created for various man-made products), in our diet.[41] Obesogens signal cell receptors to create fat cells.[42]

But these chemicals in fish are nothing to laugh at. They are of real concern to us. For example, not just mercury, but also PCB has been shown to hurt brain development of the fetus.[43]

And mercury's neurological poisoning has been shown to outweigh DHA's benefits to brain development when consumed (DHA, or docosahexaenoic acid, is an omega-3 fatty acid).[44]

I found this study that says the benefits far outweigh the risks from contaminants.[45]

Actually, our studies came to the same conclusion, that DHA is important in brain development, but sea life known to have high mercury content should be avoided by pregnant women. And they suggested no more than two servings per week for pregnant women. Doesn't sound like the benefits *far* outweigh the risks with that advice.

However, my study showed the benefits of DHA don't outweigh the harm of mercury in most fish. In that regard, your study never drew a solid conclusion (it did show some overall benefits for cardiovascular health when looking at contaminants vs. nutrition). And it did include studies that showed mercury was bad for neurological development, but it never drew the conclusion on whether DHA's brain development or mercury's neurological destructiveness was stronger. But you can just take DHA as a supplement without the mercury.

And both studies skip the issue that DHA and EPA (eicosapentaenoic acid, another omega-3 fatty acid) don't even come from fish!

They come from algae!

And biomagnification (the increasing concentration of a substance, like mercury, in the tissues of organisms at successively higher levels in a food chain) is the reason fish have such high levels of mercury and other toxins. But if you eat from the bottom of the food chain, you avoid that issue. Just supplement with an algae-based omega-3 product. Why not just cut out the middleman and not worry about mercury, dioxins, DDE, and PCB?

Plus, there is a neurotoxin called BMAA (beta-Methylamino-L-alanine) found in just about all seafood (and freshwater animals) that appears to have a strong link to human diseases that attack the brain and the nervous system like Lou Gehrig's disease, Parkinson's disease, and Alzheimer's disease. BMAA comes from blue-green algae (not the same type of algae farmed and used to make omega-3 supplements) and since algae is at the bottom of the food chain, every animal from the sea has the BMAA neurotoxin in it to some degree.[46]

And don't worry about plants from the sea. They've been shown to have pretty much no levels of BMAA. Remember, they don't eat other

organisms; they get their food from the sun. But all animals from the water eat something smaller than themselves to survive. And since blue-green algae is at the bottom of the food chain, just about all animals from the sea and even some rivers have some amount of BMAA in them.[47]

(If you're still really worried about consuming algae for your omega-3 requirements, it looks like you might not need to take an algae-based omega-3 supplement to get your DHA and EPA, but I'll talk more about that later into the book).

When you look at mercury, dioxins, PCB, DDE, obesogen, and the neurotoxin BMAA, fish really is a sponge of toxic waste. Stay away from it.

Keep it simple, make your nutrition plant-based. Then you don't have to worry about the toxic effects of animal products.

The Terrible Edible Egg

What about eggs? I read an article saying eggs are good for you and the dietary cholesterol isn't bad when it comes to plaque.

So we know for sure eating saturated fat is bad for our cholesterol levels, but is eating cholesterol itself bad for our cholesterol levels?

Let's take a look.

The “new science” on heart disease says it is not necessarily cholesterol, but inflammation, oxidation, and LDL (which can be broken up further into different sizes, but we are most concerned about the smallest as they can more easily get stuck in the artery walls) that are the problems.

Many people who advocate eating eggs give the following argument: eggs raise primarily the “good” cholesterol (HDL). And it may change small LDL into the larger, safer LDL, making it barely a contributor to any cholesterol driven heart disease (it may even be protective).

First of all, we've already established, when we talked about red meat, that all animal products have dead bacteria that will trigger our immune system and put us in a state of inflammation for hours. If you eat animal products at each meal, then you are pretty much in a chronic state of inflammation. So we are already on our way to heart disease with eggs if a main cause is inflammation.

Next, if you look at this meta-analysis about HDL increase versus LDL increase with egg consumption, the rise in LDL clearly beats the rise in HDL.[48] Yes, it raises HDL, but nothing compared to LDL.

But it's the big LDL. It isn't nearly as dangerous as the small LDL.

It is mostly the big LDL that is being increased and you are right that it isn't as dangerous as the small LDL.

But you greatly error by using the word “nearly.”

Small LDL raises your chances of having heart disease by 63%, while the larger LDL raises it by 44%.[49] Those numbers are a little too close for me. Plus, why would I want to consume food that will raise my chances of having heart problems by 44%?

But this study shows cholesterol levels barely increase overall with egg consumption.[50]

There has always been a large increase in cholesterol right after egg consumption that will last for several hours.[51] However, a lot of the studies (especially the ones funded by the egg industry) measure these levels after fasting (usually after 8 hours or after sleeping).

And that is why there are so many studies claiming eggs barely increase cholesterol levels.

Plus, it doesn't matter that it eventually lowers within several hours (usually 3 to 7 hours) as it has been clearly shown that chylomicron (mixtures of fat and cholesterol) drip into our arteries after a high cholesterol meal and this chylomicron can build up into atherosclerosis plaque.[52]

Eggs clearly add to your cholesterol and contribute to the buildup of plaque.

By the way, the author of the study you mentioned has been paid by the egg industry (though not specifically for that one study). How much? About \$500,000. You don't think that'll have some influence on how the study is done?

Remember how I talked about the possibility of some authors tweaking their results to please an industry they often get funding from?

Well, cholesterol levels don't matter. It only matters if the cholesterol is oxidized. Without oxidation, you can't get plaque.

I won't argue your last point because I don't have to. Dietary cholesterol increases LDL oxidation (by about 40%).[53]

Think about it, if you increase the amount of cholesterol in your system, but the antioxidant levels in your blood stay the same, then that new cholesterol is more likely to oxidize.

Well, this Harvard study says eggs have no effect on mortality.[54]

No, it doesn't. It says egg consumption does increase mortality if you eat more than 6 a week. That means you have to eat *less* than one egg a day. And don't people typically eat 2-3 a day for breakfast? For some people, that is 14-21 eggs a week.

If something is bad for you, you don't try to figure out a safe minimum. There is a study showing if a smoker quits before 40, he is likely to live almost as long as a non-smoker.[55] Do we tell our kids, "Hey, you can smoke just quit before 40." No! We tell them to stay away. Same with eggs: stay away.

What about the lutein and zeaxanthin in eggs to protect your eyes?

They barely contain lutein and zeaxanthin and those antioxidants originate from plants, not eggs. Again, just cut out the middleman and get your nutrition from the source.

But isn't the lutein and zeaxanthin in eggs more bioavailable?

I don't think you understand how little they contain.

You would have to eat over 60 eggs a day to get the daily recommended dose of lutein and zeaxanthin.[56]

What about the choline in eggs?

Most people already get enough choline in their diet without eggs. And too much choline is probably bad for you as it is converted to Trimethylamine N-oxide (TMAO), which appears to add plaque to your arteries.[57] So choline would be another reason to avoid eggs for heart health.

But if I eat eggs once in a while and workout, I'll be fine right?

Even if you could sidestep the cardiovascular disease issue, you still can't get away from the cancer issue. Just half an egg a day could double your chances of mouth, throat, esophageal, prostate, and bladder cancer, and triple your odds of colon and breast cancer.[58]

This increased cancer rate is speculated to be due to the choline (after it is converted to TMAO) causing inflammation in the body.[59] And wasn't inflammation one of the main causes of cardiovascular disease when it comes to the "new science" of heart disease?

Eggs have also been shown to have industrial toxins like PCB (94% of the eggs tested).[60] PCBs have a dioxin-like effect on the body by interfering with our hormones. PCBs have also been shown to cause cancer in animals.

Finally and another possible explanation for the high cancer rates, just like chicken, eggs contain potent cancer-causing viruses.[61],[62]

Just stay away from eggs.

Dairy (Far Worse than You Think)

And we have made it to the last category.

Sorry guys, more bad news.

First, let's take a big picture look like we did with red meat.

In a meta-analysis of case-controlled studies (looking at diseased and healthy people and comparing how they lived their lives), dairy consumption was shown to be a risk factor for prostate cancer. In another meta-analysis of prospective studies (following a group of people and waiting to see what kind of diseases they got), dairy consumption was also a risk factor for prostate cancer.[63],[64]

What do they mean by risk factor? Think of smoking for lung cancer. Smoking tobacco is a risk factor for lung cancer. In other words, the more you smoke the more likely you will develop lung cancer. Thus, the more milk, cheese, and other dairy products we consume the more likely we will develop prostate cancer. We'll look at some experimental studies that might explain this later.

So in a way, dairy consumption is just as bad as smoking cigarettes.

But is there a link to other types of cancer?

In another study, they showed a link to milk consumption (from cows) as a child and colorectal cancer as a senior (5,000 people were tracked from 1940 to 2005).[65]

That might sound odd at first, but it isn't surprising. Most forms of cancer get a foothold in our body during growth phases (like puberty). Our body fights it off until we get older and our immunity isn't as strong.

Is this from the hormones they inject into cows?

That might be one explanation, but studies have shown that even organic milk promotes cancer growth.

The problem is the estrogen and hormones naturally present in milk (i.e., cows do not have to get injected with hormones to have hormones in their milk). And these chemicals stimulate precancerous cells into invasive cancer cells.[66]

Why? Because milk is for babies. And what do babies want to do? Grow. But this growth signaling from hormones also signals the cancer cells to grow as well. As I mentioned above, it is during our growth phase that cancer takes a foothold in our body.

Another explanation may be IGF-1 (insulin-like growth factor 1). IGF-1 is a hormone in our body that tells us to create more cells. Necessary for when we are growing children to make sure we get bigger, but as adults we don't need it as much. The problem with IGF-1 is it tells all cells to grow (including cancer cells).

Animal protein has been linked to increased IGF-1 levels in the observational studies.[67] And the experimental studies also show that animal protein increases IGF-1 levels.[68]

So not just dairy, but all animal products (red meat, poultry, eggs, fish, and dairy) stimulate cancer growth.

Yet another reason to stay away from all animal products.

Besides cancer, milk has been linked to doubling your risk of heart attack. [69]

And guess which animal product has the most saturated fat? Red meat? Nope. Cheese.

Cheese is the number one source of saturated fat.[70] Milk itself is also very high in saturated fat. Remember how bad saturated fat is for our heart health?

And remember the 2014 Annals of Internal Medicine observational study that *tried* to show no link between saturated fat and cholesterol levels

could be traced back to someone funded by the dairy industry? Follow the money.

And what makes dairy the worst of everything we talked about so far is the addictive nature of the ingredients. This might be explained by the casomorphins (an opioid, similar to morphine, found in milk). That drug is probably there on purpose to make sure the infant calf will drink his milk and bond with its mother. This is supported by the reports of people who can easily give up all other animal products but still crave cheese and dairy after going vegan.

So while each animal product is bad in their own unique way, dairy is probably the worst due to its addictive nature.

So my advice is to not get your kids addicted to a drug.

But calcium? Where will I get my calcium?

They looked at lifelong vegan women vs meat-eating women (both in their old age) and they found no difference in bone density.[71] Apparently, the calcium in our greens is enough for healthy bones, even with the oxalates.

The Final Arguments

You're cherry picking the studies to find the ones that support your side.

We looked at extremely large studies (groups of 100,000 to 500,000 participants). We looked at meta-analysis studies. Not just one, but several meta-analysis studies.

And we looked at many studies that meat advocates cite all the time. They simply don't stand up to inspection.

Every time we examine the studies, it turns out they are the ones cherry picking (mostly by using observational studies).

Remember the study advocating fish is okay despite the contaminants, but it actually said to limit fish consumption to two servings per week for pregnant women? Or the so-called "1,000,000 person study" showing red meat didn't cause stroke and coronary heart disease, but the experimental study did show a link and the observational studies were questionable or also showed a link? How about the egg studies where they waited 8 hours after consumption to make it look like cholesterol barely increased? How about when the Masai tribe is given as an example, but the Masai work out like elite athletes and still have arteries caked with atherosclerosis plaque?

Correlation isn't causation.

True. But in *observational* studies, it is understood correlation isn't causation.

And that is why we follow up with *experimental* studies to prove our observational studies. And they do exactly that.

Like the extremely large observational studies we just talked about showing red meat being bad for you and processed being even worse. And what did the experimental studies show? The same. Red meat is bad for us and processed meat is even worse.

Furthermore, scientists are able to recreate the chemical reactions that are happening in our bodies to further explain the observational and experimental data. For example, the chemical reactions of heme iron in our colons producing DNA-damaging hydroxyl radicals explains the link between red meat consumption and colorectal cancer. And the additional creation of genotoxic N-nitroso compounds with processed meat explains why it is found to be even worse. All these reactions explain our findings in the observational and experimental studies.

At that point, the “correlation isn’t causation” argument doesn’t have any weight to it.

No more headline science guys. We need the truth if we want progress.

Let’s dedicate ourselves to being great skeptics and critical thinkers.

What Should I Eat?

This book is about the effects of eating animal products. It is not a diet book.

However, I think I would be doing you a disservice if I didn't provide some guidance.

The foods I eat are based off a lot of research, but still it's just my way of doing it. And I expect a lot of people to disagree with what I say. That's fine. Diet is a complicated issue. This chapter is here to just provide some guidance and to give some ideas you can use to create your own diet.

Do your own research. Be a skeptic of everything, even of the suggestions I give here.

And always consult with your doctor before changing your food habits.

(If this chapter seems like too much to remember, don't worry. I have some easy to follow guides at the back of the book.)

So you have three choices.

- 1.) Keep eating animal products
- 2.) Reduce animal products
- 3.) Eliminate animal products

I won't bother talking about the first option. If you choose to reduce, I think for the most part you should be okay. The less animal products you eat, the more benefits you'll get. But I would make sure to supplement with a B12 vitamin as even some meat-eaters have been shown to be B12 deficient. Still, read what I'm about to say to everyone who will be eliminating animal products from their lives.

If you are going to choose the best option, eliminate animal products, I have a simple guide for you to follow.

First, always go for whole foods. In study after study, they always beat all the other food sources when it comes to health. Even some of the good stuff in whole foods seem to become toxic to your body when taken by themselves. You need to get your nutrition in its natural form. Your body simply does best with whole foods. This means no processed foods and no oils.

Again, B12 is a must. I would maybe take vitamin D if you don't get much sunlight where you live. If you plan on being a raw vegan, then you might need to supplement your minerals. But I'm not a raw vegan, so please seek advice elsewhere if you plan on going down that path.

If you eat starch heavy vegetables that you have to cook (beans, rice, potatoes, etc.) then you should be fine mineral wise. The same goes with protein. But if you are really worried about minerals or protein (especially if you work out a lot), then just take a protein meal shake. There are a lot of vegan options out there. And you can always stop using it later and see how you feel. (Even if you do work out regularly, I really doubt you *need* a protein shake. Personally, I think they're a waste of money.)

If you're wondering about weight loss, people who turn vegan tend to not only lose a lot of weight in fat but also tend to keep it off. It just has to do with eating whole foods. It's what our bodies are built for. The fiber and synergy of all the phytonutrients (plant chemicals that work with our systems) help our bodies perform at their optimal, which means not being overweight.

That brings me to my next point, eat beans!

Remember Doctor Ancel Keys and his wife who lived so long? They loved beans. They even wrote a book about it, *The Benevolent Bean*.

And we are finding out that beans have amazing properties. Remember how iron is a pro-oxidant? Phytates, naturally found in beans and other vegetables, are antioxidants that specifically work on iron during the digestive process. They can inhibit production of hydroxyl radicals. Yes, phytates (also called phytic acid), what many meat-based diet advocates call an anti-nutrient because it inhibits mineral absorption. But, yet, a high

phytate diet has been shown in several studies to decrease osteoporosis. [72],[73],[74]

Yes, some of the minerals will be bound and harder to absorb, but that means you just eat more. And if you combine your beans, and other high phytate foods, with those in the Allium family (e.g., garlic and onion), then the absorption of iron and zinc goes up! [75]

And bean consumption is a predictor of a long life. In other words, the more beans you eat the more years you live. [76],[77]

And maybe that is why Ancel Keys lived to be over 100 years old.

It's no coincidence that the people who live in the Blue Zones, the places on Earth with the longest life spans, eat mostly or entirely a plant-based diet and lots of legumes (beans and lentils).

But many Paleo/Primal advocates warn people about the lectins in beans. So lectins are a category of protein. And this category of protein is found in both animals and plants. So technically, there are lectins in animal products as well.

Since it is a protein, a lectin's structure will determine if it is harmful or beneficial to us. Venom (not a lectin, but still a protein), for example, is very bad for us. But the protein found in sweet potatoes can help our bodies fight cancer. [78],[79]

Some lectins made by plants are designed to help them fight microbes and insects, but just because it is bad for one species, doesn't mean it is bad for us. Avocados are toxic to birds and dogs but fine for us.

Still, lectins aren't much of an issue as most protein structures are denatured during the cooking process. For example, in China they eat the stingers of scorpions after dipping them in hot oil. The heat denatures the protein and the poison now becomes a source of amino acids. This is why the lectins of the red kidney bean are no longer toxic to us once we cook them.

And depending on their structure, lectins can be good for us. Several plant lectins have been shown to have anticancer properties when they are in our bodies.[80]

But before you go eat some raw beans (don't do that), new studies show that cooked beans appear to have a much stronger anti-cancer effect than raw or sprouted.[81]

And studies have shown beans do not give you gas. So don't use that as an excuse.

Finally and you're probably still wondering why I started to talk about beans after talking about weight loss, beans are very low on the glycemic index. Not only are they extremely low, but they seem to blunt the glycemic load of foods eaten within several hours.[82]

But don't go only by the glycemic index. Potatoes are one of the highest foods on the glycemic index. But when you eat whole foods, you get a lot of protective properties, like fiber and phytonutrients. And this is proven by the fact a man ate only 20 potatoes a day for 60 days and lost weight, lowered his cholesterol levels, and his blood sugar levels stayed the same. Again, great things start to happen when you start to eat whole foods, it's what your body wants. Plus, potatoes have all the essential amino acids and lots of minerals. So eat potatoes, I certainly do.

In general, the less animal products you consume and the more fiber you eat (like beans, potatoes, and vegetables), the thinner your waist will be. It's no coincidence that vegans tend to be a lot thinner, especially in the waist, than meat-eaters.[83],[84],[85]

Okay, so we are taking our B12 (maybe vitamin D) and eating our beans and potatoes.

Next, eat your fats with your salad. We are staying low-fat, but when you do, eat them with your greens. There are a lot of fat-soluble nutrients in raw vegetables you can't get unless you consume them with fat. But no oils or dressings. Remember, we are doing whole foods only. So basically eat your nuts with your salad.

It may sound impossible to enjoy a salad like that but it isn't. Today I had a salad with spinach, kale, flaxseeds, raisins, cranberries, walnuts, and sunflower seeds. It was great. Try it! (If you don't like the taste of flaxseed, I suggest you put it in your oatmeal as you won't taste it at all like that. It's only a little bit of fat to your breakfast and the phytonutrients in them are worth it.)

And speaking of flaxseed (high in omega-3s), make sure you eat more omega-3 fats than omega-6 fats. But don't exclude certain nuts because of their high omega-6 profile. Variety is the key to being healthy.

With omega-3 fatty acids, there is some new science suggesting that ALA (the plant form of omega-3 found in flaxseed and chia seed) is adequately converted to DHA and EPA (the two other types of omega-3s) for vegans. However, this can't happen if you eat too many omega-6s. So it's only really an issue if you eat too many processed grains like bread, chips (they usually have saturated fat in them too), pastries (they often also contain eggs), and cereal or if you use too many cooking oils high in omega-6s. So you don't need an algae-based omega-3 supplement to get your DHA and EPA, but you can take it if you want.

When it comes to processed foods, I know you're probably going to buy some at the grocery store for variety and to have something tasty to eat. While we should be aiming for only whole foods, I can understand why you would do that. I do the same. However, many products, even those marketed as vegan and vegetarian, are loaded with saturated fat and sodium (sodium/salt will increase your blood pressure and that will weaken your arteries over time). I don't know if I made this point clear in the book but, except for what you find in nuts and coconuts (whole foods), you should be aiming for *zero* saturated fat in your diet as, like cholesterol, your body makes all that it needs. Even with whole foods, it's probably best to err on fewer fats than too many. With processed foods, all I can advise you to do is to get in the habit of reading nutrition labels and don't let yourself binge too much on the bad stuff. Nothing wrong with enjoying yourself once in a while (what's the point of living longer if you don't enjoy it?), as long as you are aware of what you're getting yourself into.

To recap on supplements, as a vegan always have B12 and vitamin D with you. Always take B12, but you only need vitamin D if you don't get enough sun that day (or if you live way up north or south from the equator where the sunrays are too weak for your body to use). And depending on your personal needs, an algae-based omega-3 supplement and a vegan protein supplement. Finally, even if you are taking an algae-based omega-3 supplement, consume some flaxseeds each day for the omega-3s and phytonutrients.

For food, what I usually eat for the day is what I called the simple three: oats, greens, and beans. (It's a play off of Dr. Greger's advice/rhyme of eating your greens and beans as they are two of the healthiest foods on the planet. I think he would agree that berries are a close third and that's what you put on your oats.) That's your breakfast, lunch, and dinner. Of course, it isn't that simple as you need to add others foods to get all your nutrition (e.g., rice to your beans, nuts to your greens, and berries to your oats). Also, you can always swap out foods for variety (for example, potatoes, sweet potatoes, or whole wheat noodles instead of beans for dinner). And when I say greens I mean healthy greens like kale, spinach, and collard greens, not greens with low nutritional value like iceberg lettuce. You always want dark greens. They have more protein and antioxidants. Darker colors in plants usually mean more nutrition. Red onions, for example, have more antioxidants than white onions. So go for those rich, dark colors in plants.

Here are the simple three in more detail:

Breakfast: Oatmeal with frozen mixed berries and flaxseeds.

Lunch: Salad (mixed greens and kale) with walnuts, almonds, and sunflower seeds.

Dinner: Legumes (beans or lentils) and rice.

Nothing too complicated. I mostly consume beans, rice, and potatoes. They are my big meals of the day to make sure I get enough protein and minerals. And, frequently, I'll have other smaller meals or snacks like air-popped popcorn, microwave some frozen vegetables (corn, okra, green beans, broccoli, etc.) or vegetable soup, or an apple with almond butter.

If I buy canned beans (always look for low or no sodium), I can just use the microwave for all my cooking. For rice, I either get the microwaveable rice or I'll use a crock pot. But if you notice everything else is easily cooked in the microwave. You can even microwave potatoes. But if you do that, rinse them so they are wet before you put them in or else you can start a fire.

(After doing a lot of research, it looks like microwaving is no worse than any other cooking method. It might even preserve the most nutrients.[86] Don't believe the random internet articles out there. It's not possible for microwave energy to stay on your food once the oven is off. Plus, it's non-ionizing radiation. That's the kind of radiation picked up by your AM/FM radios, cell phones, and produced by your WiFi router. And infrared non-ionizing radiation, what is produced by your microwave, is the same stuff produced by fire and sunlight. You aren't scared of a campfire or a beautiful, sunny day, are you? Keep in mind, people who get regular sunlight, for whatever reason (vitamin D, nitric oxide, dilated blood vessels, etc.), tend to have healthier hearts and lower cancer rates. (However, the sun can damage the skin and make it look older with wrinkles, age spots, and such (photoaging). So how much sun you want to get is up to you, but *never* let yourself get sunburned.) But even if you are still afraid, a little bit of the more dangerous *ionizing* radiation has been shown to be good for your health. Like a workout, your body adapts to the stress and becomes stronger. So non-ionizing radiation should be nothing to worry about.)

But do try to add variety as much as you can. For example, I try to include different spices (e.g., turmeric, oregano, and basil), mushrooms, onions, garlic (freshly crushed garlic has very strong anti-cancer properties), corn, broccoli, okra, etc. in my beans and potatoes. I'll use date sugar (crushed dates so technically a whole food) and pumpkin pie spice in my oatmeal and sweet potatoes. And my salad has all types of vegetables (beets, bell peppers, carrots, kale, arugula, watercress, etc.). You get the idea. It is all about variety to make sure you are eating healthy.

But that is just my way of doing it.

And when you start being a vegan, I would suggest you put what you eat into a food tracker for the first few weeks. This way you can get an idea what it takes to get your daily nutrient intake recommendations and you athletes can make sure you're getting enough calories, protein, and minerals for your activity level. As far as exercise goes, I'll just say being active each day (walking, gardening, taking care of your yard, etc.) is way more important than working out. Exercise is great, but being active, instead of sitting in a chair for 8 hours a day, is way more important as an hour of exercise a day won't undo the damage of a sedentary lifestyle. Lately, I've been using Cron-o-Meter (cronometer.com) as my food and activity tracker. (Just use the Recommended Daily Allowances (RDAs) in these food trackers as a general guide as they will probably change in the future as our understanding of nutrition improves. Besides, they're only recommendations for your *average* person.) While using Cron-o-Meter I realized I was a bit low on calcium and riboflavin. So I added a cup of soy milk to my diet.

Yes, soy milk is technically a processed food (soybeans or edamame would be healthier), but it's better than cow's milk. And don't worry about the phytoestrogens in soy milk unless you are drinking a gallon a day. Even for infants, consuming soy showed no effects on growth or reproductive health.[87] Soy even has isoflavones with antiestrogenic activity which might help to neutralize the phytoestrogens' hormonal effects.[88] There is a reason why soybeans have been used for millennia. Plus, phytoestrogens appear to be protective against several cancers.

For drinks in general, needless to say, stay away from the soda drinks and sugary beverages, even if they are plant-based. Your body needs the fiber to process the sugar properly. Sugar, when consumed *without* fiber, has a strong association with pancreatic cancer.[89] Steve Jobs, who was mostly a vegan, was known for drinking energy drinks, fruit drinks, and fruit smoothies all the time, and he died of pancreatic cancer (the type that comes from overactive insulin cells). (If you're now worried about your insulin levels and that type of pancreatic cancer, you should read what I have to say about saturated fat in the next chapter.) But if you do make your own fruit drinks, use a blender (so that the fiber is still in

there), not a juice extractor. But even then the fiber is broken down making it less effective (we know this by the higher spike in insulin from blended foods compared to their whole food forms). Bottom line: your body prefers your fiber intact (i.e., don't turn your whole foods into processed foods by putting them in a food processor).

Teas are generally not just good but great for you. (They come from plants. What did you expect?).[90],[91],[92],[93],[94],[95] However, some of the more exotic ones have been found to be slightly toxic.[96] (Like I said, they come from plants and some plants are bad for you.) So if you stick to the popular ones you should be just fine (green tea, peppermint tea, hibiscus tea, etc.). What about coffee? The studies show that coffee is both good and bad for you. So, unless you need it to wake you up or you really like the taste, I don't see why you would consume it. Hot chocolate, on the other hand, is great for you as long as you don't have it with all that sugar in it.[97] Just keep in mind, heat damage can lead to cancer. So regardless of what you drink, try to avoid burning your mouth and throat.

(I know there are probably some avid coffee drinkers who want to know more about coffee so I decided to add this rather long paragraph to the book. We're still learning about coffee but this is the best information I could find. Again, do your own research when it comes to your diet. Coffee has been shown to decrease the rate of several cancers and to be protective against several neurological diseases (probably from the caffeine as it's an antioxidant).[98] It also protects you from liver fibrosis (scarring of the liver).[99] While most of the studies I see say it lowers blood pressure, some say it increases blood pressure, and some show no difference at all. And when it comes to blood clotting factors/deep vein thrombosis, I've seen studies, both observational and experimental, that suggested a decrease, but I've also seen studies, both observational and experimental that suggest an increase. While I wish I could find a definitive answer, it looks like we just need more studies. However, what we know for sure is that coffee has been shown to increase LDL and homocysteine levels.[100] That's why I said it's both good and bad for you. But this is caused by the diterpenoid alcohols/diterpenes, which can be greatly reduced by using a paper filter (i.e., pouring your coffee

through a paper coffee filter).[101] Before you get too worried about LDL and your homocysteine levels, keep in mind, an experimental study showed just one cup of filtered coffee a day significantly protects LDL from being oxidized.[102] (Remember, it appears LDL must be oxidized before it turns into plaque.) And another study, though observational, showed changes in homocysteine levels were insignificant if you had 2 cups or less of *filtered* coffee unlike *unfiltered* coffee which showed a direct linear increase even at low levels.[103] And another study showed *no* change in homocysteine levels for up to 4 cups of paper filtered coffee. [104] While it may seem like a good thing to remove these diterpenoid alcohols, those same alcohols also appear to have antimicrobial, anti-inflammatory, and anticancer properties.[105] Coffee is a chemical soup and the type of bean, roast, and extraction method could all result in a different final product. (Perhaps this is why we get various results on blood pressure and blood clotting factors.) Thus, it's hard to say what chemicals are playing what role in your body. So there is some concern over coffee increasing cancer rates from some of the thousands of chemicals found in it. Acrylamide, created during the roasting process, is one such example. But we still don't know if acrylamide causes cancer in humans or not. And a review study looking at several meta-analysis studies and recent studies saw no correlation between coffee consumption and increased cancer risk except for what might be a slight association with bladder cancer for *heavy* coffee drinkers. Most of the studies reviewed defined heavy coffee drinkers as having more than 5 cups a day.[106] (However, I believe this is probably coming from the chlorine in the tap water, not the coffee itself, as most heavy coffee drinkers, I assume, are brewing their stuff at home. And I believe the reason that we *don't* see the same issue in other tissues exposed to coffee/tap water, like the colon, has to do with coffee having some very strong anticancer properties on those specific tissues.[107] I'll talk more about chlorine being in your tap water later.) The review study showed there might also be a weak link between heavy coffee drinking mothers and childhood leukemia. But keep in mind, the vast majority of the studies reviewed showed *no* link between maternal coffee consumption and childhood leukemia. Still, I think a good rule to follow is to not have pregnant women, breastfeeding women, or children drink coffee. But, overall, it clearly decreases cancer rates regardless of the acrylamide

from the roasting process. But if you're thinking about getting a lighter roast to have less acrylamide, the dark roasts actually tend to have the lowest levels.[108] But, honestly, brewed coffee is very low in acrylamide unless you are drinking instant coffee, a coffee substitute, or some unusual brew that contains the coffee grounds themselves.[109] The coffee bean is actually green when found in nature. The roasting process is what makes it that dark brown color. You can use the green coffee beans to make coffee, but you still need to cook the beans (most people boil them) to break down the bad chemicals naturally found in them (just like we do with red kidney beans). Finally, an umbrella study looking at over 200 meta-analysis studies, though the vast majority were observational, showed that coffee drinkers (with the optimal being about 3-4 cups a day) had a decrease in cardiovascular disease, cardiovascular death, cancer, and all-cause mortality.[110] However, the same study did say the only people who *shouldn't* drink coffee are pregnant woman as we see an increased rate of premature birth, low birth rate, and pregnancy loss. This might be a "correlation is not causation" issue (as a lot of coffee drinkers also smoke cigarettes), but I wouldn't risk it. You might be interested to know that this umbrella study saw no significant correlation between coffee consumption and venous thrombosis. It also saw a slight decrease in both types of blood pressure for coffee drinkers. Despite the study favoring 3-4 cups a day, given what we know about diterpenoid alcohols and other possible problems with coffee, I would play it safe and go for no more than two cups a day and let your other foods and teas play their role in keeping you healthy. So a cup or two of *filtered* coffee a day should be a healthy addition to your diet. If you want to brew your own coffee at home, you don't need a coffee maker. Just put your grounds and paper filter on a strainer over a coffee cup. Then pour hot water (I just heat it in the microwave) over it. it's about 2 tablespoons of coffee grounds per cup. But if you don't like coffee, other plant foods will give you some of the same benefits without you having to worry about the LDL increase or caffeine buzz.)

But you can always just stick to water. I prefer to put a little bit of vitamin C (ascorbic acid) in it to neutralize the destructive chlorine and its byproducts.[111] (Chlorine, an element and a disinfectant, required by the EPA to be in your tap water and found in some bottled waters, has a link

to bladder and rectal cancer (the rectum is the last part of the colon). [112],[113] While chlorine isn't technically bleach (it's *in* bleach), it's the main reason bleach works. The chlorine interacts with your tissues to create trihalomethanes (THMs), which in turn create free radicals, genotoxic compounds, and/or cytotoxic compounds (compounds that damages the cell with or without direct DNA damage) in your body.[114] So chlorine is sort of like heme iron.) Lemons, limes, oranges, crushed pomegranate seeds, hibiscus tea, or anything with vitamin C will neutralize it. However, the acids in fruits can put your teeth in a weakened state, so you shouldn't go overboard with the lemon nor brush your teeth right after drinking it. But you can always drink it through a plastic straw (or a glass straw if you want to avoid plastics). I know drinking through a straw is unnatural, but so is having chlorine in your water. (An activated carbon water filter will reduce total chlorine by about 50-70% per one older study I saw some time back. I haven't been able to find it again, but I believe the study was done in the 80s. So the filters today might do a better job. A reverse osmosis system does the best, but it removes pretty much all the minerals in water including ones that seem to be protective for your heart. Activated carbon will tend to leave these minerals in there. I'll talk more about the minerals in hard water in the next chapter.)

It seems like a few in the vegan community advocate fasting so I'll cover it here. The science shows, more or less, it can be both good and bad for you, like coffee. However, the bad parts seem to come in more and more the longer you do a fast like getting dizzy or passing out when standing. A few people have died from that (e.g., falling down the stairs). I've heard many vegans say, while they felt like they got some health benefits from it, they also felt like they did permanent damage to their bodies with a long water fast. I don't know if you can really design a study to prove this or not. But keep in mind, the vitamins and minerals in your body will decrease more and more, especially the water-soluble ones, the longer you do the fast. And not having enough vitamins and minerals in your body will definitely damage it. And you could die from an electrolyte imbalance (your heart can't pump blood) if you have kidney disease. So I would never recommend something like a 30-day water fast. It just seems too risky, especially if you are in bad health. That being said, the vast majority of people do water fasting without any problems (besides

headaches and such). As to the benefits, some studies suggest a boost in brain power/new brain cells, a maintenance mode (cells cleaning and repairing themselves) being activated by the body, and weight loss (especially when it comes to fat). But exercise will give you a lot of the same benefits. Perhaps not in the same quantities (it probably gives more brain boosting power and less weight loss than fasting), but when combined with a healthy diet it'll pretty much give you what you want. But if you do want to fast, at most I would recommend a morning fast (eating your first meal late in the day), a one to two day fast once a week (interestingly, hospitals often treat pancreatitis by having you essentially do a water fast for a few days to give the pancreas a break), or an every other day fast. And, still, get approval from your doctor first. If you do fast, keep in mind LDL (including small particle LDL) will increase and your blood will thicken as it starts to release fat to be used as energy.[115] This will make you more susceptible to sudden heart diseases and blood clots during this time. (So only healthy people should do a fast. Overweight people and those with heart conditions are better just eating fewer calories at each meal and plant foods have a very low amount of calories per volume.) But if you still plan on doing a fast, I would suggest you drink a lot of water (especially lemon water as it'll help with the LDL) and get plenty of movement to keep your arteries healthy.

But seeing that fasting is both good and bad for you, the only reason I could see anyone doing it is to accelerate/help the weight loss process as having a simple rule to follow is an easy way to restrict your calories. Personally, I don't think anyone should bother doing any type of fasting. While they don't admit it, most people do fasting to lose some vanity pounds. But chances are you gained weight because of a diet based around saturated fat and animal products (like I said, I'll talk more about insulin sensitivity and saturated fat in the new chapter after this one). And when you start eating only whole foods, you should see the weight come off gradually (as studies have found over and over again). Like I said before, vegans on average tend to be slimmer and weigh less than people who eat meat. Eat your fruits and vegetables! But, if you're healthy, you shouldn't feel too bad about eating a late breakfast or skipping it once in a while.

Finally, you can make yourself into an experimental study. Go to your doctor and have them check your cholesterol levels, C-reactive protein levels (inflammation markers), and blood pressure. (There are a lot of things you can get tested for but starting with the number one killer in the world might be a good idea.) Then go on a low-sodium, whole-food, plant-based diet (with some B12, of course) while keeping everything else the same. (But if you smoke, drink, or live a sedentary life, forget about doing an experimental study and stop abusing your body.) Then see where your levels are at in a month. And then you'll have proof that a diet based on plant food is best for your body.

Again, do your own research and find out what works for you.

That's it.

I hope this is a solid foundation for your new journey to a healthy lifestyle.

Take care and never stop learning!

And, No, Salt Is Not Good for You

While this book was supposed to be only about animal products, I ended up going back and adding this chapter here as just how the animal product industries appear to be putting their spin on the science the salt industry also seems to be playing that same game. So I wrote this chapter (which could probably be its own book).

I should warn you, unlike the first half of this book which is pretty clear, concise, and easy to read, the analysis gets pretty deep here. For animal products, not only do we not need to eat them but the less we eat the healthier we tend to be. With sodium, however, while too much is bad for you, it is a necessary nutrient. And figuring out how much we need takes some good analysis of the studies and a bit of math. But, trust me, there is an answer backed by the science.

Before we get into the spin from the salt industry, let's first understand what salt is and how it affects our bodies, and then we'll look at the long-standing science saying salt is mostly, if not entirely, bad for you.

What Is Salt?

The first thing you have to understand is salt and sodium aren't the same thing. Salt *contains* sodium in the form of sodium chloride. So to better understand salt, let's back up and understand the element sodium.

The sodium atom is usually a positively charged one (a positive ion because it has one more proton than its total number of electrons). So this atom attracts negatively charged atoms and molecules (and water molecules as they are negatively charged on one side). Thus, when you have more sodium in your blood, it attracts more water into your arteries, and that increases your blood pressure. But when sodium is already combined with a negatively charged ion(s), it's neutral (like sodium

bicarbonate or what we know as baking soda) as the ions balance each other out and, thus, those compounds can't affect our blood pressure. However, with the compound sodium chloride (table salt) your body breaks the bond to get to the chloride ion so it can be used for various systems.

But you can get plenty of chloride already from plant foods. And too much chloride (like the amount found in processed meats, cheeses, and table salt) will increase your blood pressure just like sodium does (it is a *negatively* charged ion which also attracts water as water molecules are positively charged on its other side).

And when people argue about sodium or sodium chloride being worse, it seems very much like the red meat versus processed red meat argument. Too much sodium by itself is bad for you, but too much salt (sodium chloride) is probably worse as the chloride can also add to your blood pressure.

But back to sodium.

With sodium having a strong positive charge, it is rarely found in nature without already being combined to another molecule (except for animal blood where it is suspended in water and other electrolytes and, not to get too technical here, small amounts are around our cells for various cellular processes but about 85% of your sodium ions are in your circulatory system).

That means, for the most part, you'll only have problems with sodium if you take it in the form of table salt or sodium ions suspended in a solution, like water or blood.

(If you're wondering about animal flesh itself, I was surprised. *Pure* meat is pretty low in sodium. Not as low as plant foods, but at 50 milligrams a serving you would need to eat about 6 pounds of beef to go over most sodium recommendations. But when you consider all that saturated fat, don't even think about it. Plus, almost all meats are seasoned with salt. And cheese and processed meats are often made with some insane amounts. Just stay away from animal products.)

So increasing the sodium ions in your body to unnatural levels usually means either eating sodium chloride (table salt) or processed foods containing table salt, drinking animal blood (why?) or eating processed/salted animal foods (a lot of animal foods you think aren't processed are still injected with a salt brine), and drinking soft water.

What is soft water, you might ask? Soft water systems found in homes replace suspended hard minerals (like calcium and magnesium ions) in tap water with softer minerals (usually sodium or potassium ions). The idea is that soft water works with soap better and you won't have calcium build up in your pipes and other places. While the sodium in it is in small amounts, we'll see later that even small changes in sodium can affect blood pressure. So it's no surprise when we compare people who drink soft water to those who drink hard water (regular tap water), those who drink soft water tend to have more heart disease. The evidence is there, but it's weak, probably due to the small amount of sodium in soft water (about 100-250 mg (milligrams) is consumed in a day, which is just enough to start to make a difference, but it's over 500 mg if you're drinking a gallon a day). Still, why drink something that might harm you? But if you do use a soft water system at home, potassium salts are healthier for your heart. I'll talk about the benefits of potassium later. However, considering how expensive potassium salts can be and how some of the health benefits of hard water might be coming from the minerals in it (especially the calcium and magnesium), you're probably best sticking to regular old tap water and getting your potassium from your foods.[116],[117],[118],[119]

Just think about it. We went for most of humankind without any salt. (And when you consider meat is naturally low in sodium, I find it odd how some in the Paleo movement seem to be pro salt.) It wasn't until we discovered that salt could preserve foods did we start adding large amounts of it to our diets. So why would people think salt would be good for us? It isn't found out in the wild. That increase in blood pressure just isn't natural for our bodies.

The Evidence

Blood Pressure

Now that we understand the molecular science going on, let's look at some studies to back this up. First, the observational studies.

A study looking at the blood pressure of thousands of children each year for about 15 years showed the strongest link had to do with sodium consumption.[120]

In an EPIC study looking at 23,000+ adults, it showed that more sodium consumed meant more blood pressure.[121]

Finally, the INTERSALT study, a worldwide epidemiological study (studies that look specifically at a disease and typically have experts in that field working on them), done with 10,000+ people in 32 countries showed increasing sodium intake increased both systolic blood pressure (pressure when your heart beats) and diastolic blood pressure (pressure while your heart is resting).[122]

Furthermore, the study was done in the 80s but another study re-evaluated it in the 90s and said the findings were still true today. One of the authors of the new study later went on to say that the findings are consistent with all known studies at the time (1997) including clinical observations, therapeutic interventions (experimental studies), randomized controlled trials (experimental studies), animal experiments, physiological investigations, evolutionary biology research, anthropological research, and epidemiological studies. We'll be looking at our own experimental studies soon.

So clearly, high dietary sodium intake is a risk factor for high blood pressure.

But let's take it further like we did with the Masai and the Bantu for saturated fat.

Let's look at a tribe that doesn't take table salt (as they've had very little contact with the modern world), the Yanomami Indians of the Brazilian rainforest. They have the *same* blood pressure from birth to death (which sounds pretty normal to me), unlike people in civilized society who have a

systematic increase as they age (which sounds pretty abnormal to me). Some will argue that you need certain levels of salt/sodium for health reasons (like allowing our nerves to carry electrical signals and having enough blood pressure for our hearts to pump blood). But sodium is naturally present in our foods and, apparently, these tribes, who don't even know what salt is, get enough to live into old age. (Like our caveman ancestors, their lifespans are shorter than ours as they don't have access to modern health technology and they're living in a very dangerous place, the Amazon rainforest. But even those who are very old for a Yanomami, around 60, have the same blood pressure levels since birth.)[123]

As for the extreme societies that eat salt to compare them against just look at us. How much stroke and hypertension (high blood pressure) do we have?

Now for the experimental studies. They also show that more salt equals higher blood pressure.

All animals tested on have been shown to suffer from higher blood pressure when more salt is added to their diet.[124],[125]

Why am I mentioning animal studies instead of human ones? Because *every* animal tested, even our closest relatives, had their blood pressure increase when sodium was increased. The more salt *any* animal gets, we are animals after all, the higher the blood pressure. Don't you think there's a reason why animal flesh is low in sodium and comparable to that of plants? And the few animals who evolved eating a high sodium diet developed special mechanisms to get rid of it like the marine iguanas in the Galapagos islands who swim in the ocean for food. They have cranial glands to filter the sodium out of their blood which is then shot out their noses. Before you argue our ability to sweat, you would have to sweat *heavily* for more than an hour before you lose a good amount of sodium when you consider how much we get in our Western diet (since we lose sodium through sweat that is probably why we crave it so much in the first place). And most Americans don't sweat each day. When was the last time you had a good sweat? (For all you athletes that do, I'll be talking in-depth about this later.)

And the human experimental studies? The same thing, the more salt they eat, the higher the blood pressure.

It was true for healthy, elderly subjects without hypertension.[126]

And patients of various ages already with hypertension were able to treat it without drugs by lowering their salt intake.[127]

And an experimental study with almost 500 participants reducing salt *alone* reduced blood pressure regardless of hypertension or not, race, and gender (but the people who also ate more fruits and vegetables did even better, though salt reduction had the greatest effect). The interesting part was it happened in a "stepwise fashion." In other words, even a little bit of salt out of your diet meant a little bit of lower blood pressure. And it did so significantly. "[R]eduction of sodium intake significantly lowered systolic and diastolic blood pressure[.]"[128]

So we keep talking about salt and sodium increasing our blood pressure. But is that really bad for us?

If you don't understand why high blood pressure is bad, think of pipes with pressurized water in them. With enough pressure, the pipes will burst (or at least weaken over time).

And that's why you get things like hemorrhagic strokes (strokes from ruptured vessels), transient ischemic attack (strokes from blood clots, I'll talk more on how high blood pressure can create blood clots later), heart deformities, and it might even play a role in varicose veins (those veiny lumps you often see in the legs of older people). Yes, the heart and arteries can heal themselves, but they need time to do that (that's why athletes with a low resting heart rate often have such healthy hearts, they have more time to heal between each beat). And that high blood pressure is probably actively damaging your arteries or forcing them to heal in a deformed manner. And once there is a deformity in your circulatory system, it's very unlikely for it to go back to normal. Sodium damages your heart.

Mortality

But to prove that, instead of just looking at studies linking salt/sodium consumption and blood pressure, let's look at studies showing salt/sodium consumption being connected to mortality.

Again, let's look at the observational studies first.

A 12-year prospective follow-up cohort study was done with more than 4,000 randomly selected men and women and took 24-hour urinary sodium excretion from them (the gold standard in measuring sodium levels). It showed that 13.7 daily grams of salt consumption (5.5 grams of sodium) double the chances of heart failure compared to those who consumed only 6.8 grams (2.7 grams of sodium).[129]

Finland started a national campaign since the mid-1970s to decrease sodium consumption and increase potassium, calcium, and magnesium consumption. As a nation, not only did blood pressure drop, but there was an 80% decrease in both stroke and coronary heart disease mortality. [130]

There was a meta-analysis study of sodium in regards to stroke and total cardiovascular disease following 177,025 people for 3.5 to 19 years that showed high salt intake as significantly increasing the risk of stroke and total cardiovascular disease.[131]

And, finally, a prospective cohort study of a nationally representative sample of 12,267 U.S. adults tracked over 15 years showed that those with the most sodium meant a 20% increase in all causes of death during that period. (Compared to the average American, who is already "sick" with too much salt and death. Meaning that'll be a much higher percentage compared to the Yanomami Indians). And those with the lowest sodium and highest potassium consumption (potassium has heart benefits, which, again, I'll talk about later) decreased their chance of death by cardiovascular disease by 45% and death by ischemic heart disease (another name for coronary heart disease and coronary artery disease) by a whopping 215%.[132]

You're probably wondering how sodium is playing such a strong role in death by coronary heart disease since coronary heart disease is only caused by plaque. While only atherosclerosis plaque causes it, heart

attacks (lack of blood to the heart, also known as myocardial infarction) often come when that plaque is ruptured and then a blood clot forms in the coronary arteries which can then block blood from going to the heart. (Or if a clot develops somewhere else, it can travel to your lungs and kill you.) That pressure from sodium probably makes it more likely for that plaque to rupture. This logic would explain why most heart attacks happen during exercise (like during a game of basketball) or on Monday when people are stressed about work as each activity temporarily increases your blood pressure. (Of course, regular exercise should *decrease* your average blood pressure over time.)

And it would explain this high percentage number coming from sodium consumption as death from heart attack is labeled as death from coronary *heart* disease, which is also called death from coronary *artery* disease (CAD). (To be clear, ischemic heart disease, coronary heart disease, and coronary artery disease are all the same thing. Basically, they all refer to plaque restricting blood flow in the arteries of the heart. Don't know why we have so many names for the same thing.) And, again, we would expect groups like the Yanomami Indians to have an even bigger percentage difference if any deaths at all.

We'll talk about some experimental studies in regards to mortality later, but for now let's look at some counterarguments and what appears to be spin from the salt industry.

The Counterarguments

So here are some popular counterarguments given by people who advocate a higher sodium intake or staying at the same (high) amount for the Western world.

Sodium is needed for proper infant development.[133]

That study was looking at other studies that looked at baby rats. And they gave them an *unnaturally* sodium deficient diet. Like I said, sodium is naturally present in whole foods so deficiency isn't an issue for those who eat their fruits and vegetables. And the children of the Yanomami Indians

(who add no salt to their diet) develop just fine. Sodium is an essential mineral for the human body, but we get plenty of it from plants.

But salt is needed for your brain. The kainate receptor is fundamental for normal brain function. And it needs salt to work.[134]

Looking at that study, they tested that brain receptor in solutions with and without Na⁺ and Cl⁻ present (after a computer simulation prediction). So they tested sodium and chlorine ions, not table salt (chloride is a negatively charged chlorine atom and because of that charge it doesn't have the same disinfectant properties). (Interestingly, it doesn't look like they tested sodium ions or chlorine ions alone, only together.) But like I said, sodium and chlorine ions are already present in our blood and last time I checked blood still goes to your brain (though I wonder about the people who advocate a high-sodium diet).

We have about 16,200 milligrams and 18,000 milligrams of sodium and chloride, respectively, already in our blood. And we have even more floating around our cells, including our brain cells.

(We actually have more sodium ions than chlorine ions in our blood. Grams is a measurement of mass and the sodium atom is 35% lighter than the chloride atom. So we have about 40% more sodium atoms in our blood than chloride atoms. $18,000 \times (1 - 0.35) \times 1.4 \approx 16,200$ with roughly a 1% difference from rounding the percentages.)

And your body tries to keep your sodium and chloride at a certain level, so if you eat more salt, it doesn't necessarily mean you'll have more kainate receptor activity. And that's probably a good thing.

If you ever study brain science, needless to say, it's complicated. You can't really say a receptor is good or bad. And it's hard to say how necessary one receptor is.

But it's interesting to see that kainate receptors might be linked to drug addiction. While our understanding of the kainate receptor is still new, it seems to play a role in synaptic plasticity (changes in the brain). And it seems like the more receptors you have the more sensitive the brain might be to drugs like alcohol and cocaine.[135]

Thus, it wouldn't be surprising that the more you have, the more likely your brain will change in response to mind-altering drugs. And maybe it's not the number of receptors you have, but the number activated. So if you have a high salt diet, it might activate more receptors, and then you might be more susceptible to becoming an addict. But if you're on a low or no salt diet, maybe you're less likely to become addicted to things. But that's just speculation. The point is, you can't say kainate receptors are fundamental to the brain and, thus, we need to eat more table salt. That's a silly argument. And we have plenty of sodium and chloride in our bodies already.

Well, this study says you are smarter with more sodium.[136]

And this study says you are smarter with *less* sodium, especially in the long-term.[137]

The difference between our two studies (both observational) is that mine is a cohort study, while yours is a cross-sectional study. While we've already talked about the limitations of cross-sectional studies before, one thing I didn't mention is that it's a snapshot in time. A cohort study, however, follows people and their habits (this one did it for three years). That means we can not only see the long-term results but it's also more experimental in nature (it gets more to the cause and effect).

So if you want to be smarter, you're probably better off *reducing* the sodium in your diet.

But going from a high salt/sodium diet to a low one can hurt insulin sensitivity and elevate angiotensin and renin levels.

Keep in mind those last hormones you talked about are the ones that regulate blood pressure. So, of course, they are going to change when you remove foods/ingredients that affect your blood pressure as your body is trying to keep everything in balance. You need those hormones to elevate to keep your blood pressure at a certain level, or else your heart won't be able to pump any blood. You would die!

So the more sodium you drop, the more it'll elevate those levels to keep you in balance. And that's why large increases of those hormones are typically only found in extreme adjustment cases.

But even then, those levels are naturally found in the Yanomami Indians we talked about who don't eat salt and their blood pressure stays the same for their entire lives. So those hormones shouldn't be considered elevated. They're probably pretty normal. We just have a society "sick" with salt.[138]

In regard to insulin, this study showed your insulin levels go back to normal (and it emphasizes the fact that it only happens in acute cases and, even then, the effect quickly disappears).[139]

(I should have covered this already in the book, but a lot of insulin problems come from too much saturated fat in your cells. It blocks the intracellular mechanism that responds to insulin, so your body (your pancreas) keeps pumping out more insulin trying to get a response. Yes, sugar will spike your insulin levels, but only fat can block the message and thus hurt your insulin sensitivity. And once you spike the fat in your blood through diet, your intramyocellular lipids levels (fat inside the cells) start to increase as well as insulin resistance. Just another reason to avoid animal products. Plant fats in the studies, however, like polyunsaturated and monounsaturated fat, either improved insulin sensitivity or didn't affect it at all. But, all fats are extremely calorically dense. Don't be adding pure oil, even plant oil, to your vegetables. Remember, no extracts. We're on a *whole* foods diet. And that's probably why the guy who ate almost nothing but potatoes (so very little to no fat) lost so much weight. Potatoes are full of starch (sugar) but his blood sugar levels stayed the same because your body knows how to process it when it comes from a whole food.[140],[141],[142],[143])

But there are several studies showing less sodium, at the levels you suggest, equals higher blood pressure and more heart disease like this one.[144]

That was a study done in Korea and it admits that the lack of potassium was the cause of heart disease in the study. And if you look at the

numbers, the group showing the lowest heart disease (the highest sodium consuming group) was the only one barely getting close to the *minimum* recommendation of 4,700 mg of potassium per day. And each group that reduced sodium was also reducing their potassium as well. Not only does potassium play several roles in heart health, if you don't get enough potassium your body holds onto sodium. So even if you're consuming a low sodium diet but not getting enough potassium, that sodium will be kept in your blood, add to your blood pressure, and, ultimately, destroy your cardiovascular health.

These observational studies tend to come from Asia, especially Korea, as most of them get their vegetables (their potassium) from high sodium sources like seaweed (most are high in sodium), consuming them with soy sauce (very high in sodium), stews and soups that are highly salted, or vegetables that are pickled like kimchi (pickled foods are very high in sodium). It's another case of abnormal observational studies being preached as gospel without looking at the experimental studies just like we saw with animal products.

(Let me break here and talk about seaweed as we'll be discussing it a lot for another topic. Nori sheets, what is used to make sushi rolls, have almost no sodium in them whatsoever. Other seaweeds naturally have about 150 mg per serving (10 grams). And those packages at the grocery store have about two servings. However, in the United States, it looks like most of those roasted seaweed snacks are made from nori so they are low sodium. However, most of those packages of seaweeds often have salt added to them. All I can advise you to do is to take time to read their nutrition labels for their sodium content and when you eat sushi rolls just be careful with the soy sauce.)

We even have a Korean study showing the potassium in foods like kimchi (pickled vegetables) tends to have a protective effect from the high sodium content.[145] But even then the study still found that those who ate *more* kimchi were *more* likely to have higher blood pressure. So it really wasn't that protective after all, and I can't recommend it as a health food.

And this is backed up by another Korean study showing that the young Korean men in their 20s are suffering more and more from hypertension as their diet is shifting away from Korean foods to more processed and Western foods that have sodium but little to no potassium.[146]

And don't forget about the prospective cohort study we talked about that looked at groups of various levels of potassium and sodium intake. It was the group with the *highest* potassium and *lowest* sodium that did the best when it came to death from cardiovascular disease (CVD).

So the potassium helps, but it still can't *negate* a high-sodium diet.

Well, I found this study of 101,945 people from five different continents (not just Asia) showing more salt consumption meant less mortality (including heart disease).[147]

Okay, let's look at that study. It was an observational study (as it always seems to be the case) that followed 101,945 people in 17 countries. The data suggested it is best to get between 3 to 6 grams of sodium (7.5 to 15 grams of salt), which is well above the *maximum* of 1.5 grams or 2.4 grams of sodium recommended by many health associations.

They based this off what they called a J-shaped curve in the data set. To understand what they are talking about let's understand the more common U-shaped curve. If you plotted a graph showing nutrient consumption and mortality (the y-axis/vertical line having more mortality as you go up it and the x-axis/horizontal line being more of the nutrient you consume as you go to the right), you usually expect a U-shaped curve. In other words, at deficient levels you expect a population's mortality to increase and at toxic levels you also expect mortality levels to increase. But at recommended levels, you expect to have the least amount of deaths. So you should end up with a U-shaped curve when plotting the data set. In this study, however, they found a J-shaped curve (really a backward J) in regard to sodium. In other words, you saw high mortality for people consuming the least sodium and barely any mortality for those getting too much.

Based off all the other observational studies, experimental studies, and how we understand the molecular science, we would expect to see the

exact opposite. That is, fewer deaths with lower sodium consumption (except for unnatural levels at or near zero milligrams) and more mortality the more salt consumed (a J-shaped curve but in the other/normal direction). Something isn't right here.

That study was one of three observational studies regarding sodium consumption published by The New England Journal of Medicine on August 14, 2014.[148],[149]

Let's first see what the other observational studies had to say before we get into yours.

The first study used pretty much the same data set as the one you mentioned (102,216 adults from 18 different countries) and it showed that people getting less than 3 grams of sodium a day had the lowest blood pressure (both diastolic and systolic). And for every country, there was a trend that the more sodium you added the higher the blood pressure. And the less sodium you consumed, the lower the blood pressure. (There was a small uptick in blood pressure for the Chinese population in the lowest sodium consumption group of under 3 grams, but, overall, they followed the same trend. Remember this fact for later.)

The second study looked at 66 countries using mostly urine collections as a way to measure sodium intake (just like your study did) and it determined that 1.65 million cardiovascular deaths a year were attributed to having more than 2 grams of sodium a day.

These large observational studies seem to be in direct contradiction to yours.

So what's the big takeaway here? They're observational studies, so we don't expect them to agree with each other all the time. And so we don't base our health decisions off of them. That's why we rely on experimental studies.

But let's see if we can explain away those findings in your observational study anyway.

So let's look at that third study, your study. If you look closer at the data, they break it up into five sections by sodium consumption with the lowest being the less than 3 grams of sodium a day group. That is where the J-curve starts to take off into mortality. To me, they should have broken that part of the data down into smaller groups as it contains the anomaly. But we'll work with what we've got. Looking at all the other numbers, they generally had the worst of them all. They had the highest cholesterol levels, the highest percentage of cardiovascular disease, the most calories, highest use of alcohol, and the highest use of medication, especially in regard to treating heart disease. (And these bad numbers decreased, especially regarding cholesterol and medication for heart problems, with the higher sodium consuming groups.) So one explanation that pops into my head right away is the "sick" population argument. They are already sick with atherosclerosis plaque (which can take years to treat) and they are dying before they can get better. Keep in mind that with the J-shaped curve, they were looking at *all* major cardiovascular events and cardiovascular deaths (as well as *all*-cause mortality which also had the same J-shaped curve). And, as we've discussed in this book time and time again, coronary heart disease is our number one cause of death, which is *only* caused by atherosclerosis plaque (and, no, you do not need a blood clot to block a coronary artery, it can be entirely from plaque, but high blood pressure isn't the only cause of blood clots either), and our second most common killer is stroke, which 85% of is also caused by atherosclerosis plaque. While high blood pressure certainly doesn't help, the main cause of all of this is plaque which is what this population appears to be "sick" with. (And this would also explain why the higher sodium groups seemed to die less, because, looking at the numbers, they clearly had less atherosclerosis plaque to kill them.)

Furthermore, looking at the data, the largest groups come from China (they make up about half the study). Their top killers are also coronary heart disease and stroke (but stroke comes first for China.) And China has been in the news lately about having a sharp increase in heart disease since the late 1970s. Why? Because that is when the Western diet came in. There was a shift from plant foods to animal products and processed foods. (Remember, heart disease used to be virtually nonexistent in China.) So many of these Chinese doctors started/are

recommending to their patients with heart disease (as they are also following the Western world's protocol of treating it) to change to a low-salt diet, but often don't also recommend (as they should) to stop eating animal products and processed foods. So these high-risk patients end up lowering their salt consumption significantly (as they don't want to die) but still eat red meat, processed foods, saturated fat, trans fat, and cholesterol, which keeps adding to the plaque in their arteries and they eventually end up dying of a heart attack. And that would easily explain this bizarre J-shaped curve in the data set.

Again, this is an observational study. Thus, they can get to only *potential* factors, not cause and effect. While they admit to this limitation of observational studies, they claim that their "array-approach analysis" (which is supposed to account for things like high cholesterol) makes it unlikely for their findings to be false. However, it's just a mathematical model they apply to the data set which is done for *all* observational studies. It was just a multivariate adjustment. Think about it, if everyone in your low-sodium group is sick with atherosclerosis plaque and they keep adding to it by eating animal products, it's only a matter of time before they die of heart disease. So it doesn't matter how much you adjust the numbers for that, it's going to look like a low-sodium diet equals heart disease. As I keep saying, you can only get to *potential* factors with these kinds of studies.

Another possible explanation has to do with, again, the potassium. Looking at the numbers, the group with the lowest sodium consumption had the lowest potassium consumption as well. And you need potassium to regulate and relax your heart muscles. But, as I've already said, you also need potassium to excrete (pee out) excess sodium. Your study looked at urine measures of sodium. (The theory goes that the sodium in your body is more or less at your desired amount and your body will get rid of what you consume. Thus, what is in your pee in a 24-hour period is a good indication of how much sodium you normally get in a day.) But if you aren't getting enough potassium, you aren't going to pee out that sodium, your body is going to retain it. And since that same group claimed to be eating the most fruits and vegetables (and since fruits and vegetables have on average more potassium than animal products), it

might be an indication of kidney failure in this group. (As I will talk about later, saturated fat is one of the main causes of kidney failure. Stop eating animal products.) And studies have shown urine samples to be inaccurate with those who have kidney disease.[150]

(For those who want to investigate this further, I'll give you some more info. That study did not use actual 24-hour urine collections to determine the daily sodium and potassium intake of the participants. Instead, they applied what is called the Kawasaki formula to a morning fasting urine sample to project a 24-hour number. Which is fine as this method has been shown to be accurate. However, as the study I cited demonstrates, this isn't the case with those suffering from chronic kidney disease.)

Plus, in China, like Korean, a lot of their vegetables (their sources of potassium) have a lot of sodium in them (like stir-fried vegetables and different vegetable soups). So when the doctor says to stop eating sodium (or even oil/fat because a lot of their vegetable dishes have a lot of oil in them), they might lose what little potassium (and other health benefits from those vegetables) they were getting in their diets.

Now think back to the other observational study I mentioned that used pretty much the same data set as yours with that slight uptick in blood pressure for the Chinese low-sodium group. Unnatural sodium retention, kidney disease, suddenly treating their high blood pressure with a low sodium diet, not getting enough potassium, and/or bad urine sample measurements could explain this and it would be consistent with the explanations I've been giving for the unusual findings in your observational study. It all matches up.

And I believe those are pretty reasonable explanations as to why we have this *one* large-scale observational study that is so different compared to all the other large-scale observational studies out there.

But, again, we don't really care about the *observational* studies. All we really care about are the *experimental* studies. And those done on all animals and humans consistently show sodium and salt to increase your blood pressure. Our understanding of the molecular science also backs this up.

But do we have experimental studies showing a link between sodium consumption and cardiovascular death? Actually, yes, we do.

Mortality - Experimental Studies

So in experimental studies, we have to control the groups and the variables. While this is easy for linking sodium intake and blood pressure as the change is pretty quick, showing a link between sodium consumption and death is harder as that's something that happens over a lifetime.

Then how are these experimental studies done?

Most of them involve the elderly in retirement homes since we can easily control their sodium intake and access to salt before they die. A little morbid, I know. This one had the elderly people in retirements homes replace their table salt with a potassium salt (potassium chloride). The results? A reduction in cardiovascular death and a longer life (and they even saved on medical costs).[151] Like I said, if you're going to use a soft water system at home, use those potassium salts. And if you really love putting table salt on your food, you can use potassium chloride instead.

And there are other interventional studies with younger adults (though these experimental studies can't be as tightly controlled as the ones used in retirement homes so they're a little more observational in nature). They also show the same link.

This one (thousands of 30- to 50-year-olds, followed for 15 years) didn't even bother having them increase their potassium. They only targeted sodium reduction (one of their groups also added in weight-loss). And they found the same results: more sodium means more cardiovascular death and more cardiovascular disease. By reducing sodium intake by 25%-35%, there was a 38% decrease in CVD mortality. Also, unlike your study, they made sure these people were free of cardiovascular disease and hypertension before starting it. And, unlike your study, it used actual 24-hour urine collections for sodium intake.[152]

Another follow-up study was done with the same group 5 years later (so 20 years in total) using the same 24-hour urine collection method this time looking at all-cause mortality. They saw a "direct linear association between average sodium intake and mortality." So a straight line instead of a J-shaped curve. The lowest total mortality group was those with *less than* 1 gram of daily sodium intake (way less than the 3 grams to 6 grams suggested by your study) and there was a steady increase in deaths as you consumed more sodium per day (about 12% increase in total mortality for every gram (1,000 milligrams) increase of sodium).[153]

And that's not to mention all the observational studies we've already talked about linking sodium consumption and death (which included prospective cohort studies and a countrywide study done over 30 years).

I think the science is pretty overwhelming at this point. Salt will kill you!

And just common sense would tell you high blood pressure is bad for us. Pipes under pressure will start to leak, deform, or even burst. You don't want that for your heart.

What Should You Do About Salt?

So *all* the studies out there show a link between sodium consumption, high blood pressure, and heart disease with very few exceptions. But those exceptions are observational studies which we can give explanations for.

Either the groups they studied weren't getting enough potassium, which will cause you to retain sodium, regardless of levels consumed, and you'll then suffer from more hypertension and heart disease; or they are trying to link sodium consumption to heart diseases that *only* atherosclerosis plaque can cause. I think it's a pretty clear case of another industry trying to use misleading observational studies to confuse the public.

And the experimental studies consistently showed the link between sodium consumption, blood pressure, and mortality.

There is no debate. Salt is bad for you.

But what should you do about salt in our modern society? How much should you worry about it?

Remember the Bantu people in Africa who eat mostly fruits and vegetables? Hypertension (high blood pressure) is uncommon with them. But that means the Bantu people do have *some* hypertension (1 in 10 adults) unlike the Yanomami Indians in Brazil who have *no* hypertension. This is probably because the Bantu have been exposed to the Western diet and processed/salty foods to a degree while the Yanomami have little to no contact with the modern world.[154]

That means a vegan diet is good, but a vegan diet without salt is even better for you.

But I know you probably don't want to spend your life counting your milligrams of sodium. Then I would suggest you eat more potassium (like I said, it makes your body pee out excess sodium and it relaxes your arteries). And where do you find great sources of potassium? You guessed it, plant foods. Just another reason to eat your fruits and vegetables.

Just think back to the observational study showing a decrease in sodium *or* increase in potassium decreased deaths in a population. But the group with the lowest sodium consumption *and* highest potassium consumption had the best heart health. But even that study might suffer from the "sick" population problem (keep in mind, 1 out of 3 adults over 18 have hypertension, and 1 out of 2 senior citizens have hypertension), as the lower sodium groups were probably nowhere close to the Yanomami Indian levels.

Again, I know you don't want to stress about counting your milligrams of sodium. But, I think it's still possible to add low amounts of salt to our diet without *any* risk of hypertension. Let's look at another indigenous tribe who naturally consumes sodium.

The Kitava from Papua New Guinea cook their food in seawater (so they get salt, specifically sodium chloride, what's in our salt shakers, in their diet but much less than the average American). However, they also eat a ton of potassium-rich foods (they get about three times what the average

American does). Yet, unlike the Bantu, they have *no* signs of high blood pressure. And, like the Yanomami Indians, their blood pressure stays pretty much the same their whole lives (I'll talk more about it for those interested). And keep in mind, they don't eat a perfect vegan diet. Some smoke tobacco and they all eat some saturated fats (like the occasional coconut and fish, but they eat mostly yams and sweet potatoes). So eat fruits and vegetables that are high in potassium! The more the better. [155]

(For those who want to know more about their blood pressure, their diastolic (resting blood pressure) stayed the same for their entire lives. Their systolic (beating blood pressure) had a small uptick but only in their 60s and only by 10 mmHg which still left them in what our society considers the normal range. But that's a small price to pay considering you get the luxury of eating some salt in your diet and it'll probably never cause you to die of cardiovascular disease. Heck, most Yanomami Indians don't even live to 60.)[156]

(And for those who want to know more about their saturated fat consumption, they eat fish about 2-4 times a week. Given that they do have "partly unfavourable serum lipoprotein [cholesterol] levels" and that fish is pretty low in saturated fat, they believed it was due to their daily intake of coconut. Basically, it doesn't matter where you get your saturated fat, it should be avoided as much as possible. To be fair, about 80% of the Kitava smoke. However, smoking affects HDL more so than LDL, and LDL is what was high for them. And the study even looked at smokers versus nonsmokers in regards to LDL. All males, smokers and nonsmokers, met the Mayo Clinic's definition of high but near optimum levels, 100-129 mg/dL. All females, smokers and nonsmokers were high for heart disease, 130-159 mg/dL. The difference was probably due to the males being more physically active. (And this is probably why people who go Paleo can often post improved cholesterol and blood sugar levels despite the increase in saturated fat as they sharply increase their physical activity as well. So if you end up eating fatty foods or animal products on the holidays, do some push-ups, squats, sit-ups, and walk around the neighborhood or the mall with the family. But like the Masai, the Paleo community is probably still adding layers of atherosclerosis

plaque to their arteries which can lead to a heart attack just like the guy who started the jogging craze in America. Stick to plant foods.) Don't forget the "sick" population argument and the fact that heart attacks are the number one killer in the Western world. These numbers are probably way too high if you want to avoid heart attacks altogether. While there were no heart attacks, ischaemic heart disease, found among the Kitava, they are active all day long, like the Masai. And since you are probably at school or work sitting at a desk all day, your best bet is to avoid all saturated fats in your diet. Your body can make its own.)

If you're wondering which plants have a lot of potassium, it's mostly the starchy kind like potatoes, sweet potatoes, winter squash, and acorn squash. And guess what the Kitava eat? Starchy tubers like yams, sweet potatoes, taros, and cassavas. So if you really want to avoid hypertension, start adding starchy foods to your daily diet. But keep in mind, other whole foods like spinach, broccoli, kale, lentils, pinto beans, black beans, and bananas are pretty comparable. So just make sure you eat a *variety* of fruits and vegetables, avoid the salt shaker as much as possible, avoid processed foods, and you should be just fine. But keep in mind, the Kitava are also out in the sun (which helps to dilates your arteries/lowers your blood pressure) and are active. So get out in good weather whenever you can.

If you do add salt, do it very sparingly. You can still add a little salt to a whole foods diet *if* you prepare *all* your meals from scratch and still be below the American Heart Association recommendation of no more than 1,500 mg of sodium a day. A fourth of a teaspoon of salt a day is about 500 mg of sodium and half a teaspoon is 1,000 mg of sodium. But keep in mind if you season your food with salsa, hot sauce, ketchup, or other pre-made condiments, they tend to already have a good amount of sodium in them. So make sure to read your nutrition labels. Even plant milks tend to have some sodium in them. Unsalted vegetable broth also has a good amount of sodium in it as well (vegetables, while low in sodium, tend to have the highest natural levels of all the plant foods). Personally, I pretty much never add table salt to my food.

In short, if you do get table salt in your diet, then add some potatoes (or other starchy tubers) to your diet. And try to get some fresh air, sunshine, and exercise while you're at it.

(Since *white* potatoes are low in antioxidants for a plant food (remember, darker colors in plants generally means more antioxidants), I try to eat them with other plant foods high in antioxidants like hibiscus tea, spinach, beans, lentils, turmeric, tomatoes, etc. I think even ketchup and mustard have a decent amount of antioxidants in them as they contain tomatoes and turmeric, respectively. This way I don't have to worry about an inflammatory response in my body from a lack of antioxidants in my potatoes.)

Kidneys and Perspiration

And don't worry too much about getting enough sodium as healthy kidneys are good at retaining the sodium you need. But if you're wondering about how much you sweat out, exercise for half an hour and you'll lose between 100 mg to 500 mg depending on how much sweat you produce (which is about the amount you'll find in a sports drink) so you can adjust accordingly. (However, if you're outside on a very hot day while playing a sport, you can lose up to 1,000 mg every half hour. I'll talk more about handling this situation later.) So losing too much sodium can happen to marathon runners, but if you restore your sodium during or after each workout (but you also need other electrolytes which we'll also talk about later), you won't have to worry about getting enough during each meal as I said healthy kidneys will keep sodium in. A good-sized, healthy salad full of a variety of vegetables (without dressing or salted nuts) will probably get you 100-200 mg. And that's probably enough in a day unless you sweat. There are no recommended minimum levels of sodium as no one is found deficient unless you do marathons or have a disease that will cause you to pee it out. Think about it, if our kidneys weren't able to retain sodium at their proper levels, then everyone who did a 30-day water fast should be dead at the end like those marathon runners who drink too much water. But they do it without any heart problems except for a very few who probably had kidney disease. And if you're worried about kidney disease, the top causes are adult onset

diabetes (the type that has to do with insulin sensitivity, which we know now is caused by saturated fat—avoid animal products) and high blood pressure itself (avoid the sodium). But besides animal fat, animal protein seems to produce toxins that overwork, put pressure on, and, ultimately, damage your kidneys.[157] So it's no wonder that people on a plant-based diet tend to have healthier kidneys.[158] The good news is a plant-based diet can also be used to treat kidney disease.[159]

Iodine

And if you're going to use salt, you might as well use iodized salt. Iodine is an element and a micronutrient (so you only need a little bit and too much is bad for you, but it's still an essential nutrient). This is why it's often called a trace element or a trace mineral. However, if you're eating processed foods, you're probably getting way too much salt and you shouldn't be adding any salt, including iodized salt, to your foods. But if you're now worried about getting enough iodine you should read what I have to say before supplementing.

(There's going to be a lot more analysis. Unlike sodium, we don't know exactly how much iodine is in our food. So I ended up doing a lot more number crunching here. In short, you should have nothing to worry about as long as you eat a *variety* of fruits and vegetables. The only exception might be athletes and pregnant and breastfeeding women. But if you're in one of those groups and just want to know how to play it safe, look at the Supplement Guide in the back of the book.)

Many will claim a vegan diet will cause a goiter (swelling of the thyroid gland, a gland in your throat/voice box, so it can absorb more iodine from the blood) because that diet doesn't supply enough iodine. However, a vegan diet seems protective against hypothyroidism (underactive thyroid disease from too little iodine that often goes with 90 percent of goiter cases).[160] Compared to meat-eaters and different types of vegetarians, vegans were the least likely to develop the disease. Meat-eaters and lacto-ovo-vegetarians (vegetarians who consume dairy) had the highest rates. And the study pointed out that *obesity* has the strongest link to hypothyroidism (even just being overweight had a stronger link than diet).

Plus, another study on rats showed that a diet high in saturated fat deformed the thyroid, disrupted thyroid hormones, and of course, they gained weight.[161] And another study on mice showed that a high-fat diet and excess iodine work together to damage the thyroid.[162] Sure, we would prefer human studies, but I think they link the other studies together pretty well. Remember, milk, cheese, and butter tend to have the most saturated fat compared to other animal products. Milk and dairy products also tend to be high in iodine because of the disinfectants given to cows. That's probably why those lacto-ovo-vegetarians had the highest rates of thyroid problems in the study. And since vegans tend to be slimmer, don't drink milk or eat dairy products, and eat less saturated fat in general, that might explain why they had the lowest rates of thyroid disease amongst all the groups in the study.

The History and Molecular Science

But back to goiters specifically. To better understand what is going on with goiters, let's look at its history in America and the molecular science. Two-thirds of your body's iodine is in your thyroid, it needs it to produce key hormones. When it doesn't get enough, it'll tend to enlarge to capture more iodine from the body. (Don't let people scare you from eating plant foods because of goitrogenic compounds, compounds that block iodine absorption. The levels are extremely small in the few plant foods that have them and they've been shown to not have any effect on the thyroid.[163],[164],[165] Plus, several, like isothiocyanates, have been found to be antioxidants and anticancer, especially for thyroid cancer.[166] Only soy seems to have a moderate amount of its own goitrogenic compounds, but the experimental studies show no real interference with thyroid function.[167],[168] The bottom line is if you have a goiter, it's because you're not getting enough iodine.)

Before salt was iodized, goiters were commonly found in places far from the sea with a lot of rivers and lakes, like North America's Midwest (especially close to the Great Lakes), and places that block rainwater from the sea, like North America's Intermountain regions.[169] This is because oceans are the world's main source of iodine and very little is found in the soil. The reason soil isn't rich in iodine is the same reason the

Great Lakes (and lakes in general) aren't salty like the sea: rivers and rainwater pull minerals (iodine and sodium are minerals) out to the ocean. (Whether rainwater, even that from the sea, adds or takes away minerals all depends on if it is able to drain to the ocean or not. If a valley is designed right, it can retain a lot of the minerals brought from the ocean. And this is one of the reasons why California's Central Valley, even though being close to the sea, has the world's largest patch of top-tier soil and why it is used to produce half of the nation's fruits and vegetables. This is also why some parts of this same valley have very high concentrations of salt. The other way to get iodine and other minerals, and where oceans got their iodine originally, is through volcanic activity. And that is why Yellowstone National Park is so flush and full of life even though it has several mountain ranges to the west blocking seawater rains.) To treat the high rates of goiters in places with low iodine rates in the soil, companies started to iodize their salt in the 1920s. And now goiters are virtually nonexistent in America. So many argue all salt should be iodized.

Hyper and Hypothyroidism

However, since our oceans have so much iodine, eating a little bit of seaweed can provide so much you won't need to eat more for a long time (enough for weeks or even months). Keep in mind too much iodine can induce not only hyperthyroidism (overactive thyroid from too much iodine) but also the hypothyroidism that we talked about earlier. And it seems like supplements can cause subclinical hypothyroidism even when *total* iodine intake is under most nations' maximum recommendations of 1,000 mcg. (That is 1,000 *micrograms*, not milligrams. And that amount is equal to 1 milligram. Like I said, it is a *trace* mineral.) And subclinical hypothyroidism was almost at a 50% rate for those getting a 2,000 mcg supplement.[170] Yet, the Japanese who get a lot of iodine from seaweed (1,000-3,000 mcg) had very low rates of subclinical hypothyroidism (<6%).[171],[172] Even then, it appears those with subclinical hypothyroidism had "disturbed lipid metabolism" which usually means elevated LDL levels, which might be a sign of too much saturated fat in the diet. And we know by now how much saturated fat can hurt the thyroid. But before you binge on seaweed, they still had pretty high thyroid abnormalities in general (1

in 10) for those 40 and older (Americans have about the same rate for those 60 and older) and see what I have to say about cancer next.

Cancer

Let's now look at cancer and iodine. Too much iodine seems to have a link to thyroid cancer. This has been found in several countries when they started to supplement their iodine in their salt.[173],[174] This isn't too surprising as iodine is used as a disinfectant because it is a pro-oxidant (the same iodine they used to treat goiters was used to disinfect). So just as we see iron oxidation causing rectal cancer, it isn't surprising that iodine might be causing thyroid cancer. However, just as beans have phytates to protect themselves from iron and thus us when we eat it, plants high in iodine probably have some type of phytochemical(s) to protect themselves from iodine and thus us when we eat it. So it's probably best to get your iodine through whole foods and not through a supplement. But even then, there might be a weak link between high iodine levels from seaweed and thyroid cancer.[175] That Japanese study showed the people who ate seaweed daily were 70 percent more likely to develop cancer than those who ate it twice a week or less, postmenopausal women were four times more likely. However, another study in the same journal four years later showed *no* increase in cancer rates for those same groupings, including postmenopausal women (at least nothing statistically significant).[176] Both were prospective observational studies of similar size and length, so it's hard to draw a solid conclusion. (In an attempt to explain the differences between the studies, keep in mind, Japanese markets tend to have a wider range of seaweeds to buy and some of those exotic seaweeds have a year's worth of iodine in a serving. Plus, like some exotic teas, these exotic types might have chemicals in them that are toxic to humans. So when you eat your vegetables from the sea, like your tea, stick to the popular, normal stuff.)

But looking at all the studies in their totality, it seems it's better to get your iodine through whole foods, like seaweed. And not getting enough iodine can lead to mental deficiency, deafness, stunted growth, thyroid cancer as well, and even death. (So don't feel too bad about binging on that

seaweed.) Furthermore, thyroid cancer seems to have a stronger association with obesity than anything else.[177] And, like I already mentioned, obesity is also the strongest factor in the thyroid disease hypothyroidism. These correlations might be explained by too much dietary saturated fat not only damaging the thyroid but also adding weight to your body through insulin resistance. And a vegan diet can help prevent all of that.

Counterargument

But increasing your levels of iodine through iodized salt have been shown to increase IQ.

Before I answer you, let's back up and understand the science. The reason your thyroid has high levels of iodine is for hormone production. Those hormones are believed to play a role in brain development. As such, pregnant women, nursing women, and infants need to have adequate iodine levels (with nursing women probably needing the most).

But that increase in IQ was only in the 1920s when goiters were prevalent. And those lower IQ rates were only found in places where the soil was low in iodine. So it isn't specifically iodized salt but iodine itself. (Again, why not get your nutrition/iodine through whole foods?) Keep in mind, it was in the 1950s when the national highways were built in America so we are no longer bound by the vegetables grown in our local soil. We can even buy seaweed at our local markets for goodness' sake. And in soils where iodine is low, most developed countries that grow crops there now fertilize with iodine. Even a lot of less developed countries are now fertilizing their soils that are low in iodine with iodine-containing water. And, yes, they are seeing an improvement with IQ. [178],[179]

So, like I said, is it very important for pregnant women, nursing women, and infants to get enough iodine. But that's why they should be getting regular checkups and blood tests from their doctors. Chances are if you're low they'll just give you a prenatal vitamin and you'll be covered. (While it is preferable to get your iodine through whole foods, the one exception I would make is for lactating women as iodine is constantly being lost

through breastmilk. And as low iodine has a link to both breast cancer and fibrocystic breast disease and when you consider its importance to your baby's brain development, you're probably better off using a prenatal vitamin while breastfeeding. But make sure your prenatal vitamin actually has iodine in it as half of prenatal vitamins checked didn't have iodine. [180] So you need to read the labels. Interestingly, the study showed some of the prenatal vitamins used kelp (seaweed) instead of potassium iodide. While all the kelp versions did contained iodine, they varied from 33 to 610 mcg per daily dose.)

(If you're pregnant but want to go a more natural path, you could eat nori sheets. Those roasted seaweed packages found in the United States are often nori. Unfortunately, they often don't list the type of seaweed on the package, but if salt is listed in the ingredients and the Nutrition Facts label still gives a low sodium count, it should be nori as nori itself has virtually no sodium in it while other seaweeds have quite a bit. Based off of various websites I see, they list nori on the low end compared to other seaweeds of having 12-18 mcg of iodine per gram. With about 10 grams a serving, one serving of roasted seaweed will give you roughly the extra 150 mcg you are looking for as a pregnant woman. But as I'll slow later, even as a pregnant woman, you might still be getting plenty of iodine through whole foods.)

Remember the study showing a low-sodium diet increased intelligence? Considering most table salt is iodized, don't you think the results would have been screwed up if iodine was that important later in life for human intelligence? If you want to be smarter, you're most likely better off with less salt.

Of course, this is probably making you wonder if you are getting enough iodine from your foods. We'll be answering that next.

Am I Getting Enough Iodine?

Finally, there seems to be a lot of misinformation on iodine in regards to how much different foods contain and how much we need. The standard recommendation for adults in the U.S. is 150 mcg per day. Children should get about 90-120 mcg depending on their age. Breastfeeding and

pregnant women have higher requirements of 290 mcg and 220 mcg, respectively. (I think governments overstate their guidelines for toddlers, 130 mcg, because iodine is so important to brain development, so they would rather have you get too much at this stage than not enough.) If you're worried about getting enough iodine during breastfeeding, like I said you can take a prenatal vitamin which most contain about 150 mcg of iodine. Again, read the labels as half of prenatal supplements don't contain iodine. More is probably safer than not enough. And if you get the occasional high levels of iodine, especially through a whole food like seaweed, I imagine you'll be fine if not better off.

Keep in mind, our bodies adapted to having various levels of iodine intake. You normally have about 15,000-20,000 mcg in your body with most of it, about 10,000-16,000 mcg, in the thyroid. But, unlike sodium and other electrolytes in your body, your kidneys can't hold on to it (as far as I can tell from reading the medical literature, that's probably why we lose about 90 percent of what we eat daily through our urine[181], or about 100-200 mcg, and thus the 150 mcg daily recommendation). While your kidneys can't hold on to iodine, your thyroid can. Your thyroid has a 100-day half-life with iodine. So if your thyroid got 1,000 mcg from your diet in one day, 100 days later it would still have 500 mcg of it. Your other organs can also hold on to iodine for weeks to months at a time. But iodine is mostly used for your thyroid (though your body needs the hormones the thyroid produces with iodine). It seems to play some minor roles in other tissues, but what it does exactly is unknown. While your kidneys may not have a mechanism to retain iodine when needed, your kidneys are very good at getting rid of excess iodine, at least if it's from a whole food like seaweed. Several Japanese studies show up to 97% urine excretion of daily consumed iodine of up to 30,000 mcg/L.[182] And after that, it goes back to the standard 100-200 mcg. And, as I'll prove later, getting that 150 mcg of iodine through whole foods in a developed country isn't hard at all. But, like sodium, iodine is lost through your sweat. So athletes who sweat a lot will need to take measures to make sure they're getting enough iodine. Again, I think it's best to just restore your electrolytes and iodine levels right after a workout so you don't have to worry about adjusting your intake levels during meals. But when it comes to sodium and iodine, this is the only place where you might get into

trouble, so I'm going to take a good portion of the book here to talk about what you can do. I'll talk about getting iodine through whole foods after that.

Restoring sodium and iodine after a workout

(If the math here makes your head spin—and I don't blame you—just look at the Supplement Guide at the back of the book.)

Sports drinks, like Gatorade, tend not to contain iodine. Well, you can always make your own sports drink. While I said to stay away from fruit drinks, the one exception is probably right after or during a workout when your body can use the sugar. Based on the different numbers I see in studies, I would guess about 3-15 mcg of iodine is lost in your average 30-minute workout (and like I said before, that'll also be about 100-500 mg of sodium lost). You can add an eighth of a teaspoon of iodized salt to get your 250 mg of sodium and 30 mcg of iodine. (Iodized salt in America is supposed to contain 45-75 mg of iodine per kilogram (kg) of salt. But a study showed more than half tested fell below that.[183] So we'll take the lowest number of the range, that's about 45 mcg of iodine per gram (g) of salt. There are 5 grams per teaspoon of salt, so 225 mcg of iodine. Divide by 8 and you get about 30 mcg of iodine.) Or if you want to avoid using table salt, you can use something like strawberries and celery. Strawberries tend to pick up and hold more iodine than any other plant. After biofortification, they can hold 60-400 mcg/100g.[184] A cup of whole strawberries is quite a bit more than 100 grams. So I'm pretty confident that'll get you at least 15 mcg even if it isn't biofortified. Add about 3 cups of chopped celery to your strawberries and you'll get about 250 mg of sodium. Of course, you can add an apple or orange for taste (just so you know, like most fruits, they have pretty much no sodium in them).

Or you can avoid the sugar altogether and juice vegetables. Remember, leafy greens and vegetables, in general, tend to have a lot of iodine, sodium, and potassium in them. Beets, spinach, and celery should give you a nice amount of those minerals. (Don't forget beets have been shown to improve athletic performance.) And when you add regular tap water, that's going to be adding your calcium and magnesium ions. As I'll

prove later, you lose very little calcium and magnesium through sweat so the amount in your tap water should be fine.

So that should cover most people who workout at a gym. (And you probably noticed while looking at the numbers that most people won't even need a DIY sports drink, especially if you don't break a sweat, that they can easily get what they need through eating whole foods. I'll be talking more about that later.)

However, if you're outside on a hot day playing an intense sport like soccer, you can lose up to 2,000 mg of sodium and about 50 mcg of iodine an hour.[185] Almost half of the athletes in that study had a mild goiter.

(For those interested in how I've been getting my numbers and whether you need to worry about other electrolytes, I'll talk about it here. Per the study above, we lose about 37 mcg of iodine per liter of sweat. Since you lose about 0.8 liters of sweat during indoor recreational sports/working out per hour, that's about 30 mcg iodine lost per hour or 15 mcg per half an hour. But a lot of people barely break a sweat in an air-conditioned gym so I started at a fifth of that. That's where I got the number above. They also said there is about 1270 mg of sodium per liter of sweat. That times 0.8 liters gives about 1,000 mg. And that's how I got about 500 mg per half an hour workout. Again, considering that most people in an air-conditioned gym barely break a sweat, I gave the range of 100-500 mg sodium lost during a workout. Potassium and calcium lost was minimal. They didn't look at magnesium or chloride nor could I find other studies covering it. But I we can calculate that as the amount of electrolytes lost seem to be in the same ratios as they are found in your blood, as your sweat glands don't appear to regulate your electrolytes lost through sweat. It involves converting meq/L (milliNormal per Liter) to mg/L and then multiplying that by the 5 liters of blood in the body. Potassium and calcium is about less than 1,000 mg each in your blood (which is consistent with the amounts found in our sweat per the study). Magnesium is about 150 mg. So the amount sweated out is probably undetectable and is probably why they didn't talk about it in the study. We've already covered chloride being almost equal to sodium in our blood, 18,000 milligrams. As such we can assume we lose about the

same amount in our sweat. But I wanted to make sure. Luckily, they use chloride levels in sweat to test for cystic fibrosis. They say 39 mmol/L or less means no cystic fibrosis. So we'll take the worse case but still healthy scenario of 39 mmol/L, which converts to 1,380 mg/L. So about the same rate as sodium and about the same ratio of chloride to sodium in our blood. Remember, milligrams is mass so we have 40% more sodium atoms in our blood and sweat than chloride atoms. So if table salt (sodium chloride, a one to one ratio by atoms and about a 4 to 6 ratio by mass, respectively) is getting you enough sodium, it's certainly getting you enough chloride atoms. If you're now worried about getting enough chloride without table salt, foods that are naturally high in sodium (spinach, celery, seaweed, etc.) are also naturally high in chloride in roughly the same amount. And your kidneys retain chloride just like sodium. So, also like sodium, there is no recommended minimum. But the point I'm trying to make is that athletes should be fine using table salt since it'll get them plenty of chloride as well.)

So here's what you can do. Add a fourth a teaspoon of iodized salt to get 500 mg of sodium and 60 mcg of iodine and three-fourths of kosher or sea salt (pure salt) to get the remaining 1,500 mg of sodium and split that between two 16-ounce water bottles (32 ounces altogether or 4 cups). Throw in some juiced fruits or vegetables for taste, sugar, antioxidants, and other trace minerals. You will need something to mask the salty taste. If you add a lemon, a lime, and 4 cubes of sugars (60 calories) to a 16-ounce bottle, it tastes surprisingly like Gatorade. Hibiscus tea will probably be another good thing to use as it has a lot of antioxidants, lowers your blood pressure, and has a fruity taste to it. Now you're making your own natural and probably healthier versions of lemon-lime and fruit punch Gatorade. Then drink one of those after or during (but only *after* you've started to sweat a lot) every hour you play a sport out in the hot sun. Everything else you drink should be just water. Now your student athlete and marathon runner has a sports drink based on the science. Just make sure they're getting enough potassium in their diet so their body can filter the excess sodium if they're not sweating enough. Those athletes sweating heavily outside were losing about 250 mg of potassium an hour. (So when you apply the math nothing to really worry about for everyone else working out inside. But if you're an athlete and

you're remembering the 1,000 mg in our blood and scared by that 250 mg number, 98 percent of your potassium isn't in your blood but in your cells and your body can pull it out as needed. Still, considering potassium's heart benefits and ability to help you pee out excess sodium, it wouldn't hurt to add some potassium to our sports drink.) For athletes who want to make sure that they're keeping their potassium levels topped off, add half a cup of coconut water to our 32 ounce mixture (there is no saturated fat in coconut water). It'll give about 250 mg of sodium and about 600 mg of potassium a cup. So about half the sodium of our DIY sports drink per cup. Unfortunately, I can't find information about its iodine content, but being a plant food it probably has some.

For those interested in pink Himalayan salt, while I couldn't find a study on the mineral content, I found the following from what seemed like a somewhat reliable source online: chloride, 590 mg/g; sodium, 380 mg/g; sulfur, 12 mg/g; calcium, 4 mg/g; potassium, 3.5 mg/g; and magnesium 0.1 mg/g. There isn't enough potassium or magnesium to really help, but it's interesting that they're there nonetheless. However, the amount of calcium might be enough to make a difference as those athletes on a hot day were losing about 20 mg an hour and you'll get about 10 mg in half a teaspoon. But calcium is probably the least important mineral when it comes to sweat as bones are a huge reserve for this electrolyte. So you can always wait until you get it from food. A second source online gave the following measurements: chloride, 590 mg/g; sodium, 380 mg/g; sulfur, 1.7 mg/g; calcium, 1.4 mg/g; potassium, 3 mg/g; and magnesium, 20 mg/g. Here there is enough magnesium to make a difference, but not calcium. So mineral content seems to vary a good deal by brand. For iodine, the first source said less than 100 mcg/g for iodine so about twice the amount found in most iodized salt. (It said less than 0.1 grams which I assume they mean per kilogram as they state that for just about all the their other minerals. I worry this might not be accurate as they used a different measurement method for iodine and one other mineral which is also stated as less than 0.1 grams. This is why I prefer peer-reviewed scientific studies.) The second source gave about 1 mcg/g. Big difference. All the minerals after that, about 80, were in microscopic amounts. Unfortunately, we don't know what those minerals do to your body. But we do know most are present. Trace amounts of aluminum, bromine,

rubidium, and vanadium are found throughout the body. Arsenic, gold, cobalt, chromium, indium, antimony, and titanium are also found in various amounts in human organs.[186] Just how iodine plays a mysterious role in tissue health, besides being used by the thyroid, these other trace minerals might be used by the body for various things. Though you could probably argue we also get those minerals in various plant foods. For example, there is titanium in your plants. And trace amounts of it seem to really improve plant health.[187] As with iodine, plants tend to absorb whatever minerals happen to be in the soil. So your body probably evolved to handle a variety of minerals, even toxic ones. Though, as we'll see with iodine, what minerals get absorbed and held onto the most will vary with each plant. Thus, as always, eat a *variety* of fruits and vegetables, so you don't get too many toxic minerals (like mercury or arsenic) or not enough necessary trace minerals. The point I'm trying to make here is that you probably shouldn't be afraid of taking Himalayan salt because of the exotic trace minerals. But you shouldn't take Himalayan salt to get those exotic trace minerals either as you should get enough through common foods (both plant and animal). (I would still venture to say it's best to get your trace minerals through plants. Why? Because since plants are in the soil and can't move, I imagine they would have to evolve some type of mechanism to protect itself from toxic minerals in the soil by not absorbing them or by binding them to something.) Besides, the mineral content for Himalayan salt seems inconsistent going from one brand to another. But for your DIY sports drink, you're probably fine replacing a fourth of a teaspoon of your kosher or sea salt with Himalayan salt to make sure you get enough but not too much iodine.

(If you're wondering about how much of the non-electrolyte minerals, like iodine, we lose through sweat, it doesn't seem to be a concern. For zinc you lose about 5 percent of your Recommended Dietary Allowance (RDA, how much you should be eating each day) per hour of sweating. So that's about 0.5 mg. And I would guess for athletes out in the hot sun about 1 mg. For iron, you lose only about 1 percent of your RDA per hour.[188] It seems like only iodine is the exception to this pattern.)

While iodine is a problem for athletes, sodium loss still seems to be the main issue. That's probably why we hear about marathon runners dying and having heart problems from not having enough sodium and never really hearing about them having goiters. So you can see the problem sweating too much in the hot sun can cause us. This is probably why we, like many animals, crave salt so much. Better alive with high blood pressure, even with a shorter life, than dead today with low blood pressure. But even better is alive today with low blood pressure and a long life. And thanks to modern society, we can do that. And this is probably why a lot of Paleo people who work out a lot swear animal products make them feel better. It's not that it's better, rather they are probably getting the sodium their bodies want, though unnaturally as animal flesh is naturally low in sodium. But if you don't sweat a lot, then you need to avoid daily excess levels of sodium and supplemental iodine unless you want thyroid cancer and dysfunction or cardiovascular death.

But what if you work out and don't want to make or drink a sports drink? What if you only want to eat whole foods? Well, if you just go to your local gym and work out for half an hour, a cup or two of beets will do you just fine. A cup of raw beets will give you about 100 mg of sodium, 130 mg for cooked. Being a dense vegetable it'll probably give you about 10 mcg of iodine per cup (more on how I got this number next). So for your average 30-minute workout that should be more than enough sodium, even if you do sweat a decent amount, by the time you include the sodium and iodine in all your other foods, especially if you're living in a developed country. And you're probably fine eating a sodium-rich whole food *before* you work out as it'll take time for your body to start absorbing it, unlike a juice. So you don't have to worry about your kidneys pulling it out of your blood before you can start sweating it out. Again, don't forget, beets have been shown to improve athletic performance (plus, beets dilate your arteries and thus lowers your blood pressure). You can't go wrong with a whole food diet. But if you don't have beets, celery and carrots together should be a good alternative for your sodium and iodine. So only athletes and marathon runners sweating a lot will have to worry about drinking a sodium and iodine rich sports drink. But that's enough about drinks. Let's talk about food.

Iodine in Our Food

So how much iodine is in our food? While many say potatoes are high in iodine, some studies show they are some of the lowest in certain regions. [189],[190],[191] They show as little as a few micrograms per kilogram. (For those who read the studies, 1 microgram = 1 mcg = 1 μ g = 1 γ (gamma). Gamma is a symbol that has been deprecated but you'll see it in the older studies I cite. Most medical literature will show " μ g" (μ stands for micron) for micrograms to prevent doctors from confusing it with milligrams and potentially giving a lethal dose of something.) The highest plant foods in these studies (besides seaweed) by weight were regular vegetables. So probably the greens or vegetables you would use in a salad have the most natural levels of iodine (same with sodium). And, again, a lot of it has to do with what soil everything is grown in (it ranges anyway from 10 mcg/kg to 1000 mcg/kg in soil dry weight). However, if the potatoes are *biofortified*, then, yes, you will probably get about half of the mcg recommended daily from a single meal.[192] But how do you know if your potatoes are biofortified? (Biofortified can mean a range of things, but in regard to iodine, at least with most of the research I've come across, it means they enrich the soil with iodine.)

But it's not as bad as I'm making it sound. Let's look at potatoes in America before biofortification and see if you could still get enough iodine. A study in the 1930s looking at potatoes in Minnesota (right next to the Great Lakes, so the eastern soil should be very low in iodine) found that potatoes from the western soil had more iodine and people had lower rates of goiters there compared to people living in the eastern soil.[193] The rate was about 2.5 times more iodine in the western potatoes (about 22 mcg/100g). That's a pretty high number. But the middle part of the United States is some of the most fertile (since the rainwater there can't easily drain to the ocean) which Minnesota is close to. So let's look at a state closer to the ocean. Another study done in the 1930s for Pennsylvania found about 7 mcg/100g on average, with the most being about 20 mcg/100g and the lowest being 1 mcg/100g.[194] (For those looking at the study, p.p.b., parts per billion, equals 1 mcg/kg, as there are 1 billion micrograms in a kilogram.) (Those extremely low levels came from areas, which are now state parks, covered in rivers. And if you look

at a terrain map, you'll see they're also covered in valleys carved out by the dendritic drainage systems a long time ago. And those old rivers carried the iodine out of the soil. But I imagine most modern farms wouldn't bother growing potatoes in a place like that.) So if you get potatoes from western Minnesota back in the 1930s, about 3 cups will give you more than 120 mcg. (Cups are a measure of volume. And grams are a measure of mass. But a cup of potatoes is about 200 grams). When you consider 2 heaping cups of leafy greens will give you 10 mcg and 2 cups of solid vegetables (like carrots) will give you 20 mcg, then you get to 150 mcg.[195] But if you're eating potatoes from Pennsylvania back in the 1930s, you would have to get about 8 cups to get to a little less than 120 mcg. Sounds like a tall order, but when you consider the guy on the all potato diet was eating 20 potatoes a day (1 medium-sized potato is roughly 1 cup), it probably isn't that hard. So, back in the 1930s, the people who got goiters were either in very poor soil or they weren't eating enough. (If you're wondering why those levels in the potatoes from those first three studies were so low, it had to do with the fact they were by the sea where rainwater can carry soil iodine out to the ocean, like Norway or the Chinese Fujian province, or it probably had to do with the Chernobyl accident of 1986. The third study was from Belarus and the Chernobyl accident was on the border of Ukraine and Belarus. It threw radioactive iodine all over their soil that was already the richest in the country for iodine.[196] So they were forced to move their crops to the northern less iodine-rich soil. And those who didn't had a higher rate of thyroid cancer. Even then, the average iodine levels are pretty low in that country from the start as there is no volcanic activity there.)

But we live in modern times and you probably live in America if you're reading this. Your produce most likely came from the California Central Valley or the fertile middle section of the United States. If not, there is a very good chance that your potatoes will be biofortified with iodine. And beans have about 18 mcg/100g and rice 14 mcg/100g so if you want to eat them instead you're also fine.[197] Sweet potatoes contain about 12 mcg/100g.[198] (If you look at this study, you'll notice, when grown in the right soil, potatoes and beans can contain very high levels naturally, 62 mcg/100g and 53 mcg/100g, respectively. And this is typically the levels you see when you biofortified them.[199] And if you look at *that* study and

wonder why their foods are already high in iodine *before* biofortification, it's because Nigeria has many recently extinct volcanoes in the area. See, science can explain everything. And the science is clear on what kind of diet you should have and how much sodium you should eat.) You're not going to be iodine deficient if you eat plenty of whole foods in a developed country. Even if you drink plenty of water in a day, you'll get about 10 mcg from that alone.[200] (Remember, water pulls out minerals, like iodine, from the soil. This is why you want a *hard* water, not a soft water, system at home. Unfortunately, activated carbon filters are very good at removing it from your water. This probably has to do with treatment plants turning iodide (ionic, single atom version of iodine) into a compound (usually, two iodine atoms joined together) making it larger and harder to pass through the activated charcoal filter.) And don't forget, strawberries can have a lot of iodine in them. So I think the best strategy is to eat a *variety* of fruits and vegetables, and have the occasional seaweed (they do make vegan sushi rolls, again, just be careful with the high in sodium soy sauce) or iodized table salt (a fourth of a teaspoon of iodized salt will give you about 60 mcg of iodine) and you'll be just fine. The only exception would be if you are running marathons or sweating for hours in the gym or if you're pregnant or breastfeeding, then, yes, you'll probably need to take some extra steps to make sure you are getting enough iodine.

Protecting Your Thyroid

Finally, keep in mind your thyroid and body needs the mineral selenium to protect itself from the oxidative effects of iodine. While iodine is naturally a pro-oxidant, selenium is naturally an antioxidant. Without selenium, your thyroid produces hydrogen peroxide which starts to damage your thyroid. [201] It may also protect you from over and under thyroid stimulation.[202] Like iodine, your thyroid also needs selenium to produce key hormones. Where do you get selenium? Whole foods. Brazilian nuts, sunflower seeds, tofu, black beans, chia seeds, whole wheat pasta, mushrooms, brown rice, and oats just to name a few.[203] Even seaweed has trace amounts in it.[204] And this might partly explain why we tend to see an increase in thyroid cancer and thyroid dysfunction more so for supplements than whole foods. So eat your whole foods, but eat a *variety* of whole foods.

While iodine might seem confusing, just try to use whole foods to get your nutrition, including those from the sea. And, remember, thyroid dysfunction and cancer have a stronger link to meat, saturated fat, and obesity than anything else. Plants appear to be protective for both thyroid dysfunction and thyroid cancer. It appears best to get your iodine through whole foods and not through supplements or salt. If you're pregnant, breastfeeding, or have a toddler, have your doctor check your iodine levels and your toddler's iodine levels to be safe. And if you are going to use table salt, I would still use an iodized one as you should only be using a *little* bit of it anyway (and thus only a little bit of oxidative stress) and it'll help make sure you get enough iodine. Plus, the plants you should be eating anyway with their various antioxidants will still protect you from the pro-oxidant effects of iodine. So eat your fruits and vegetables.

Conclusion

So what should you do about salt? Like animal products, at the very least you should reduce your intake.

Remember, the American Heart Association recommends *no more* than 1,500 mg of sodium a day. And studies show that less than 1 gram (1,000 mg) a day will give the best results. There is no recommended minimum. Unless you sweat a lot or have kidney disease, you shouldn't worry about getting enough sodium, you should worry about getting too much. Again, athletes and people who sweat a lot should just restore their sodium and iodine levels during or after a workout so they don't have to adjust the amounts in their meals. But everyone else should stay away from sports drinks. And if you're in a developed country, you're probably getting *way* too much instead of not enough. Yes, you need *some* sodium, but that can be found in whole foods. Most vegetables will have about 20 mg a cup (most fruits have pretty much none). And, remember, a fourth of a teaspoon of salt a day is about 500 mg of sodium and half a teaspoon is 1,000 mg of sodium. Don't forget that many condiments like salsa, hot sauce, or ketchup can have a high amount (about 100 mg a tablespoon). And also don't forget, a lot of meat is injected with a salt brine. Processed foods, salted meats, and foods prepared in restaurants (they tend to use kosher or sea salt, not iodized salt) are why most Americans get in the

unhealthy range of 3,000 to 6,000 mg a day. And if you eat that stuff often, you'll end up with hypertension just like them.

But, remember, the studies show it's progressive, so even if all you do is reduce the salt in your diet you should see benefits regardless.

And reducing sodium in your diet means you'll have to take time to read the nutrition labels of processed foods if you eat them (even vegan ones can be loaded with sodium and saturated fat). You don't need to add up the milligrams, but you do need to be aware of what you're putting in your mouth. And the best thing you can do is to stop eating processed foods (don't be eating those salty chips), prepare your own foods, and keep eating plenty of fruits and vegetables.

You're Wrong About Working Out

Always consult your doctor before starting a workout program.

And I was motivated to add yet another chapter to this book. Why? Well, I found out some very interesting stuff about working out and I found, unfortunately, more headline science.

At this point, perhaps I should make this book an all-encompassing one about health. Ignoring treatments for various diseases, the four pillars of good health are sleep, nutrition, exercise, and socializing. We've covered nutrition so let's briefly cover sleep and socializing before we move on to exercise. I'm not citing studies for these two areas as the science is pretty clear, there really isn't that much misinformation out there about them, and if we do learn something new it probably won't be a game changer when it comes to your actions toward them.

With sleep you need an adequate amount each day and you should go to sleep and wake up at the same times each day. What is an adequate amount? Basically, sleep until you feel rested. Anyone saying there is a specific amount of time you should always sleep is trying to sell you something. You already have a bodily system that tells you how much sleep you need each day. Don't make it complicated. Now if you don't get enough sleep in a day, unfortunately, you really can't catch up on it in another. In fact, too much sleep can be harmful. You can, however, take a power nap in the middle of the day which will help your brain clean out the adenosine (a natural byproduct of normal brain activity that needs to be cleaned out for your brain to function properly). Adenosine is actually one of the chemicals that make you feel sleepy. And the way caffeine works to make you feel more alert is by blocking the adenosine receptor sites in your brain. More sleep, however, isn't the same as napping as there are other specific biological functions taking place that can actually be harmful if done too much, which can give you a higher risk of stroke

and heart attack. This happens because your body glues everything back together while you sleep. But too much “glue” can restrict muscles, like those in your heart. But napping pretty much just takes care of the adenosine in your brain (about beyond 20 or 30 minutes is when other sleep systems start to engage). And napping appears to be so beneficial that pretty much everyone should take a 10- to 15-minute power nap in the middle of the day as it'll make you more productive later on.

As far as when to go to sleep, like I said, try to do it at regular times. While you don't necessarily need to go to sleep at sunset, it is best to wake when the sun comes up as it appears that waking up in the hours just before that stresses out your body the most. Probably because it expects the sun to wake you up and relies on chemicals that start to be produced in your brain when light/sunlight starts to hit your body and eyes (even through your eyelids). From an evolutionary point of view, this makes a lot of sense. A campfire probably kept our ancestors up beyond when the sunset, but they probably still relied on the sun to wake them up. I know this is a luxury not everyone has because of their work or kids, but at the least try to go to bed and wake up at the same times each day as it appears that your body will adapt to it in time.

And that brings us to socializing. So what does socializing have to do with being healthy? A lot more than you think. In short, the people around you affect your emotions, which in turn affect your hormone levels (like cortisol, the stress hormone, or oxytocin, the so-called love hormone), and your hormones affect your tissues (cortisol tends to damage your tissues and oxytocin tends to repair them). So it isn't surprising that studies find those who spend more time with their friends who make them feel good tend to be healthier. And those who spend more time alone or with people who stress them out tend to have a shorter life. And I'm sure there are plenty of studies showing the same effects when you donate or help others as it makes you feel good, creates that sense of belonging, and thus releases those beneficial hormones. So be social, help your friends, and be part of your community. Actually, the science shows the best living situation for your health and happiness is one with your friends, a community that you enjoy. Unfortunately, the Western world seems to advocate isolating living situations (like owning your own house) or social

situations that will stress you out (like living in a dorm with a complete stranger) instead of living with a group of friends you enjoy.

So those are three of the four pillars of health. Let's move on to the final pillar: exercise.

As I said, there is some exciting news here, but to convince you of it, I'm going to use some graphs here. Why? Well, nutrition and convincing people to go vegan is pretty easy as everyone knows that the more fruits and vegetables you consume the better and that meat, at the very least red meat, tends to be bad for you (but as you now know, from reading this book, *all* animal products are bad for you). So convincing people to only eat fruits and vegetables and no animal products (a plant-based diet) isn't that hard. It only required me to disprove the false claims made by the Paleo community by showing how they used bad studies or improperly read them.

But what I'm going to show you with exercise goes against the conventional wisdom we've all been taught when it comes to working out (that we pretty much have to go to the gym just short of every day to be really healthy). So I'm going to finally have a few graphs and tables in this book to help convince you.

So what is that general advice we've all been taught? Well, that we have to go the gym 3 to 5 times a week to be healthy, that we have to do cardio *and* weight lifting, and, since we broke down our muscles so much from lifting weights, we need to eat a lot of protein before and after.

But the new science emerging suggests we only need to work out once or twice a week to get all the benefits (and not for that long either). And we really don't need to lift heavy weights at the gym, so we don't need to gobble down tons of protein (those protein supplements are pretty expensive and often contain heavy metals as they aren't regulated), to get the maximum health benefits.

Too good to be true? I know, I couldn't believe it myself. But the numbers don't lie.

Let's look at a study that examined over 50,000 subjects (18 to 100 years old) for 15 years.[205]

What did it find? That all joggers, *regardless* of dose, frequency, or speed, had a 30% and 45% lower risk of all-cause and cardiovascular mortality, respectively.

This included runners who did *less* than 50 minutes, less than 6 miles, who only worked out once or twice a week, and at less than 6 mph. The only thing that really made a difference was if they stayed runners or not in their lives. So consistency is a *must* when it comes to working out.

The study then pretty much suggests in the conclusion to run 5-10 minutes a day at slow speeds. I sort of disagree with their conclusion (I'll go into that later), but I think the authors were obviously trying to give the reader the bare minimum they could do to get the best results. But, remember, even working out once or twice a week produced the *same* results. In theory, can't we just work out on the weekends and aim for a total of 30-45 minutes of exercise for the week?

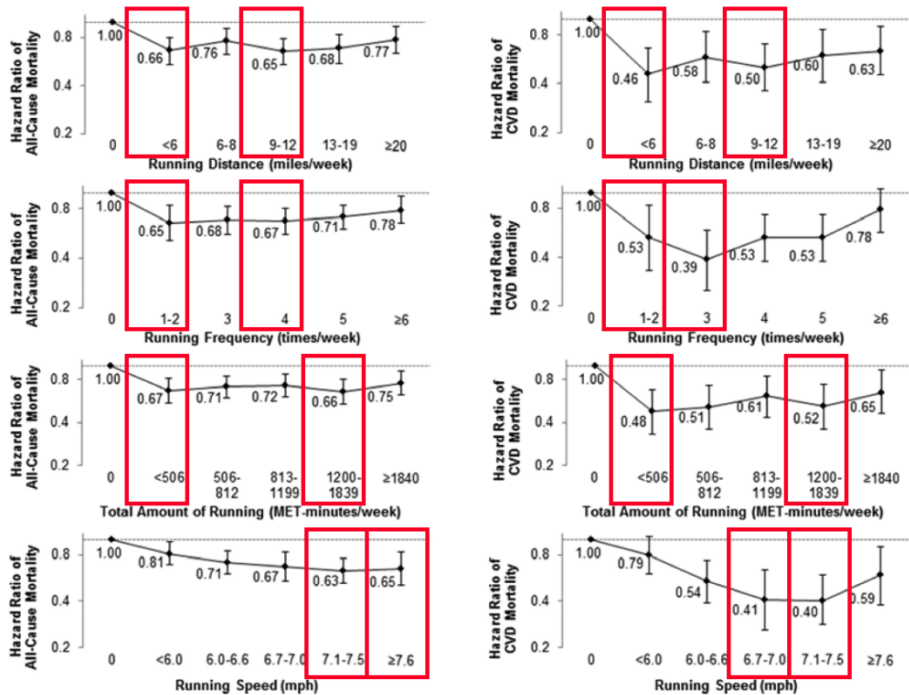
But why would we want this strategy? Because it addresses the fundamental problem of working out 3-5 times a week. Making time to go to the gym after a busy work or even school day is a pain. You have to remember to work out on certain days. You also have to remember to bring your workout clothes. You have to drive to the gym or where ever you're going to go to work out. Change clothes. Follow some boring routine for an hour. Shower. Drive back. Rest. Then you probably need to get some work done while still being tired/sore from the gym. And you have to do more laundry now cause you have a lot of gym clothes to wash each week. This is all even worse if you are stressing out about a project you need to get done by Friday but are forcing yourself to make time to work out during the week. Those are hours you could be working or de-stressing. So it's no wonder people give up on the gym and just live their lives (even though we all need exercise to be healthy).

But like I said, consistency is a *must* when it comes to exercise. Thus, we should only advocate a workout routine that people will *actually* do, not one that will make them feel guilty.

So can we just work out just once or twice a week?

While the study did say it was more or less an equal reduction in each category for the week, we did see some groupings do slightly better than others (especially for speed in regard to cardiovascular health). I'll insert the graphs to make things clear.

On the left is all-cause mortality rates and on the right is cardiovascular disease (CVD) mortality rates. By row, we have distance, frequency, MET-minutes/week (more on this later), and speed. I put a box around the best and second best scores for each graph.



As you can see, with the exception of speed (intensity), the best or second best numbers (the lower the better) for each graph always came from the lowest groupings.

(I think why you see the CVD mortality rate being so drastically low for those jogging 3 times a week (relatively speaking, as all the groups had about the same amount of benefits) has to do with how serious they are about health. Joggers who make time to religiously jog three times a week (probably Monday, Wednesday, Friday, the ideal plan we've been historically taught as it gives the highest frequency for the week while still giving joints plenty of time to heal) has to do with the fact that if they are that serious about exercise, they are probably taking other health factors, like sleep and nutrition, just as serious too. And we should know by now how important diet is in regard to cardiovascular disease.)

Now what is this MET-minutes/week number? It is simply a measure of effort over time. (MET stands for Metabolic Equivalent of Task.) So if you did an activity rated with a MET of 4 for 30 minutes, you simply multiply the two numbers and get 120 MET-minutes. Or you can increase your effort and decrease your time for the same number. So doing an activity with a MET rating of 8 for 15 minutes would still give you 120 MET-minutes.

So if you jog at a speed of 7.5 mph that'll give you a MET rating of about 10 (MET varies by individual, so this is just an approximation). If you do it for 30 to 45 minutes, you get 300 to 450 MET-minutes, below the 500 MET-minutes/week (one of the optimal groupings). It also puts us at below 6 miles jogged, which is, again, another optimal group in the study for mortality rates. Have that total of 30 to 45 minutes jogging come from one or two workouts a week, then you are, yet again, in an optimal grouping when it comes to mortality, all-cause and cardiovascular, per the study.

So not only can you jog only once or twice a week, jogging once or twice a week at 7.5 mph for under 45 minutes is the *best* jogging program you can do for your health.

That's amazing!

I know right?

But you should still build up to that if you are new to working out as jogging for 45 minutes straight at 7.5 mph could *literally* kill some of the

people reading this right now. And, as always, consult your doctor before doing a new workout plan.

And in the name of good science, we should explore other studies (we'll look at another one later) and other evidence. Here is one from my personal account.

After reading a news article reporting on this study, it gave the advice, as is found in the conclusion of the study, to jog each day for 5-10 minutes under 6 mph. So I started to jog for a minute, then two, then three, until I built up to 7 minutes each day at a slow speed (I even measured my speed with my phone). And this was after reading a lot about proper running form and helpful techniques. So as far I know, I was doing nothing wrong or improper with my workouts. But after a few weeks of that, I started to get terrible pains, like little pebbles were in my toes, enough to force me to stop jogging. If you do the same exercise each day, you're going to get repetitive use injuries. With the exception of walking, our bodies are designed for long rest periods and variety. I think this is further proven by the graphs above. The *least* optimal groupings, besides those who didn't work out at all, were those working out every day. Again, even more reason to do your workout once or twice a week.

(If you do go read the study, there was another graph in it showing minutes jogged (*not* MET-minutes) per week and mortality. (I'm not showing the graph as it has a bunch of overlays which makes it hard to read and confusing to see what is going on.) Other than the non-jogging group, those with equal to or less than 50 minutes did the worst for CVD disease. And, oddly enough, the 51-80 minutes did the best. But this was an error in the graph. If you look at Table 3 in the study, they accidentally pulled the all-cause mortality number for that time and matched it against the cardiovascular mortality number. The 50 minutes or fewer group actually had the best number of 0.45 (a 65% reduction in mortality). The numbers are as follows: Non-runner, 1.00; <51 mins., 0.45; 51-80 mins., 0.52; 81-119 mins., 0.60; 120-175 mins., 0.53; and >175 mins., 0.67. Less seems to be more when it comes to working out.)

The overall message seems to be less time working out at a higher intensity and more time for your body to heal is optimal.

But why is this?

I mean why in the course of evolution would we be designed like this, to work out really hard once or twice a week? Actually, I never answered the question of why from an evolutionary perspective would our bodies react so badly from eating animal flesh?

If you think in terms of the African savanna, it makes a lot of sense. According to paleobiologists, meat was a rare commodity back then as it had to be hunted so we got most of our calories through plants.[206] As stated by Amanda Henry and followed up by the author of the article:

“Frankly, I think that misses half of the story. They want meat, sure. But what they actually live on is plant foods.”
What’s more, she found starch granules from plants on fossil teeth and stone tools, which suggests humans may have been eating grains, as well as tubers, for at least 100,000 years—long enough to have evolved the ability to tolerate them.

But seeing that meat is high in energy (fat) and contains other nutrients our bodies might be low in if malnourished (like cholesterol), our bodies adapted to soak it up like a sponge when we did eat it as not having enough calories and nutrition to live was a real issue back then.[207][208] All that your genes care about is living long enough to reproduce, not to live to a ripe old age with healthy arteries. So when we go from meat being an occasional thing (I would guess once a week or even once a month) to having it every day, or even with each meal, our bodies absorbing all that excess fat and cholesterol ends up wrecking our system.

(If you are wondering what the difference is between fat and cholesterol, let’s first say what they have in common: they are both lipids. That means they are in the same chemical category as oils and waxes. However, unlike fat, you can’t break down cholesterol through exercise. It needs something to bind to so that the body can flush out excess amounts. That’s why oatmeal and other plant foods are so good at reducing cholesterol. They have chemicals in them, like certain fibers, to bind to it.)

Even when things got better for the human species, it was with the agricultural age. So we got more grains to eat, but meat was still rare, something for the rich. And there was a lot more poor than rich back then as it is now. Thus, human evolution would still favor plants as our main food source. So we are designed to eat plant foods and that includes starchy tubers and grains that you have to cook. Remember how the poor in India and China had pretty much no heart disease? That's because they were eating a proper diet based on our evolution.

But how does this relate to exercise? Well, back to the African savanna. If meat was that rare, then so was running at prey full speed (or jogging, however we did it) as well as running for your life from a predator as we lived in tribes (there is strength and intimidation in numbers that even nature respects). But we *did* once in a while run at full speed for whatever reason (even when it was done for the occasional play). That would support the idea that we are designed for sudden, intense exercise and a lot of recovery time. And that seems to agree with the jogging study we just cited.

I don't know. That is only one study. Do you have any other studies supporting the occasional workout being ideal?

I sure do. Let's look at a study that specifically looked at the weekend warriors.

In this study, they looked at about 64,000 adults (40 years or older) over 14 years that resulted in about 9,000 deaths.[209]

The study split the group into four main categories: inactive (individuals who did not work out or do any real physical activity), insufficient activity (those who didn't meet the World Health Organization's recommended 150 min/week of moderate exercise or 75 min/week of vigorous exercise), weekend warrior (those who met the WHO's recommendation through 1 or 2 sessions a week), and regular activity (those who met the WHO's recommendation through 3 or more sessions a week).

Again, we have four groups: inactive, insufficient, weekend warrior, and regular exercisers.

Comparing the three workout groups to the inactive group, they pretty much had *equally* decreased their rates of all-cause mortality by 30%, cardiovascular disease mortality by 40%, and cancer mortality by 20%.

(Cancer rates were slightly in favor of more working out by a few percentage points. The insufficient activity group averaged 60 minutes working out a week, the weekend warriors averaged about 300 minutes working out a week, and the regular activity had about 450 minutes working out in a week. But, again, these few percentage points' difference might have to do with regular workout people being more thoughtful with their other health factors, like sleep and nutrition. Keep in mind, just how serious joggers usually go 3 times a week, serious gym goers typically go 5 times a week (Monday through Friday while alternating muscle groups) and eTable 9 seems to confirm this. After one or two workout sessions, cancer mortality rates go up (as well as all other mortality rates), drop significantly for 5 sessions, and then start to go back up again. So it probably isn't how much you work out but how much you take care of all your other health factors that account for the lower cancer rates.)

I'm curious; did the people who worked out twice a week do better than those who did it once a week?

That's a good question. We know the study states that about half of the weekend warriors got their exercise once a week and the other half got theirs twice a week. So we have plenty of data to pull reasonable conclusions. Look at eTable 9, all mortality rates of people who worked out once a week compared to twice a week were virtually identical (if anything it slightly favored working out once a week). In fact, they pretty much did better than all the other frequency groups except for the five times a week group. Again, those who go to the gym Monday through Friday probably take other health factors more seriously and thus the better results. I should also point out that CVD mortality rates were the worst in people who worked out seven times a week or more. Give your heart a rest.

Now to the subject of headline science, there are a lot of well-known magazines citing this study (at least on their online articles) saying you can work out just once or twice a week, but they claim that there is a

catch. And that catch is supposedly that you have to meet the WHO's guideline of 150 min/week of moderate exercise or 75 min/week of vigorous exercise.

No. It does not say that.

Like I mentioned before, *all* groups almost equally decreased their chance of death, whether they met WHO's guidelines or not.

This is what it said: "One of the most striking findings in the present study was that 1 or 2 sessions per week of moderate or vigorous-intensity leisure time physical activity was sufficient to reduce all-cause, CVD, and cancer mortality risks **regardless** of adherence to prevailing physical activity guidelines." (emphasis mine)

Keep in mind, 60 minutes was the average amount of working out the insufficient activity group did with about 25 minutes of that being vigorous (and that matches the ideal range of less than 50 minutes and less than 500 MET-minutes in our jogging study). That puts it *well below* the guidelines of 150 minutes and 75 minutes for moderate and vigorous exercise, respectively.

Furthermore, eTable 8 made a final adjustment for survey years. (If they believe a survey year had a high error rate for whatever reason, they would give it less of a weight). After that final adjustment, the insufficient activity group did *better* than weekend warriors (people meeting WHO's guidelines) for all-cause mortality, CVD mortality, and cancer mortality rates.

Finally, and this gets so interesting that I wanted to include the table, when you break out the insufficient activity group into 1 or 2 sessions and 3 or more sessions, (as they did in Table 4 of the study) the insufficient group doing only 1 or 2 sessions beats the weekend warriors so much so that it is almost on par with the regularly active group when it comes to total mortality. There is only a difference of 1% point.

Table 4. Cox Proportional Hazards Regression for Associations Between Physical Activity Pattern and Mortality, Distinguishing Between the Insufficiently Active Groups^a

Physical Activity Pattern ^b	No.	Mortality, HR (95% CI)		
		All-Cause	CVD	Cancer
Events		8802	2780	2526
Inactive	39 947	1 [Reference]	1 [Reference]	1 [Reference]
Insufficiently active, 1 or 2 sessions	11 067	0.66 (0.62-0.72)	0.60 (0.52-0.69)	0.83 (0.73-0.94)
Insufficiently active, ≥3 sessions	3157	0.82 (0.72-0.95)	0.79 (0.60-1.01)	0.99 (0.79-1.24)
Weekend warrior	2341	0.70 (0.60-0.82)	0.60 (0.45-0.82)	0.82 (0.63-1.06)
Regularly active	7079	0.65 (0.58-0.73)	0.59 (0.48-0.73)	0.79 (0.66-0.94)

Abbreviations: CVD, cardiovascular disease; HR, hazard ratio.

^a Models adjusted for age, sex, smoking, occupation, and long-standing illness.

^b Physical activity patterns were defined as follows: inactive, not reporting any moderate- or vigorous-intensity physical activities; insufficiently active, reporting less than 150 min/wk in moderate-intensity and less than 75 min/wk

in vigorous-intensity activities; weekend warrior, reporting at least 150 min/wk in moderate-intensity or at least 75 min/wk in vigorous-intensity activities from 1 or 2 sessions; and regularly active, reporting at least 150 min/wk in moderate-intensity or at least 75 min/wk in vigorous-intensity activities from 3 or more sessions.

I want you to take note of the cancer mortality rate for the insufficient activity group doing ≥3 sessions. It is virtually equal to the inactive group. How is that possible? I believe this is probably the group of people who go to the gym three times a week and only go through the motions. That would suggest that if you want the cancer-fighting properties of working out, you need *intensity*. Keep in mind the weekend warriors got 94% of their exercise through sports. And sports are basically as intense as you can get. You're basically going all out. The insufficient 1 to 2 session activity group probably had a similar percentage number (i.e. they also got their exercise from sports). The regular activity group had 75% of their members getting some of their workout from sports. And the other 25% is probably the gym nuts who don't mess around when they get there (they do high-intensity exercises).

(I want to say that this is some great reporting done by this study. Remember my main complaint against that large pro-sodium study, that they didn't break out the anomaly? Here, there really wasn't an anomaly on the surface, but they kept breaking down the data (even giving additional tables online) which let them make amazing discoveries with it and helps with my analysis. The jogging study also did a good job breaking out the data. If you ever become a researcher, these are the standards you want to aim for when it comes to writing your reports.)

That's it. You only need to work out once or twice a week. And it doesn't have to be the gym. You can play a sport, hike a mountain, canoe a river, or whatever. Just do something that gets your heart going. But if you do

go to the gym, make it a social activity. Remember, being with friends is one of the easiest ways to get healthy and feel good. Don't go to the gym alone.

And don't worry about overdoing it and trying to stay away from the weekend warrior category. The weekend warriors in the study averaged about 300 minutes a week. If you spend 4 hours hiking a mountain, that's only 240 minutes. Now if you hike a mountain every week, then you might be overdoing it. Just go for variety. And the best way to do that is to schedule something that sounds like fun, not work. Go for a fun bike ride around the neighborhood. It doesn't have to be hard.

But you *do* need to make sure you do something *each* week. Write it down in your schedule and plan it ahead of time with your friends.

I don't know. Do I really not need to lift weights?

Probably the only group that should do weight-bearing exercises for sure are the elderly as it can build mineral density of the bones and help prevent osteoporosis. But lifting weights isn't the only weight-bearing exercise out there. Jumping rope[210] and jogging[211] has been shown to build up the mineral density of the bones. There are a lot of weight-bearing exercises that are a lot more entertaining than mindlessly lifting weights at the gym. Or you could just buy some dumbbells at home to lift for a few minutes each day.

But besides that, you just need to be physical on the weekends. I think a new workout guide, based off these studies, should be 30-45 minutes of vigorous exercise (where you have moments where you are trying to catch your breath, like a sport where you run), or 1-1.5 hours of exercise where you breathe hard from time to time (like hiking a mountain with a gradual incline). Sure, I'm probably erroring on more than what the studies suggest, but at least the numbers *are* grounded in the studies. And if you go over or under at times, that's not a big deal as it'll all average out. *The important thing is that you get out there each weekend.*

Isn't it all kind of beautiful? I mean the world's healthiest diet is one that doesn't involve hurting animals. The world's best workout (at least the

most bang for the buck workout) is one where you can have fun with your friends on the weekend.

It's basically 30 minutes of working out instead of 7 hours! (The regular activity group was about 450 minutes or about an hour each day...) And you'll get the same results.

Wait, won't I get injured if I'm a weekend warrior?

Well, if you're playing a sport, for certain there is a chance of injury. But most acute injuries (like a rolled ankle or pulled tendon) tend to heal just fine if you give them time to heal and range of motion (you are giving it 5-6 days at least with this schedule). Chronic injuries (ones that build up over time) are the ones that never heal properly. That's because you are constantly deforming the tissue while it is trying to heal by putting weight on it. So if you're working out several times a week, you're greatly increasing your chance of chronic injuries. And major acute injuries (like a ruptured Achilles tendon) usually come from a chronic injury that has been getting worse with time. Or they come from physical contact sports. So full-contact football would be a bad sport to play if you are doing it for health benefits. Probably the same for, and I hate to say this as I love the sport, basketball as there is a lot of aggressive body contact involved. But touch football is probably a great sport to play as well as baseball, softball, tennis, and racquetball.

If injuries really scare you, then don't play sports. There are plenty of other activities that will get your heart rate up, like hiking, cycling, and jogging. And you can still go to the gym (just do it on the weekends, make it short and intense, and go with your friends). Don't worry too much about injuring yourself. The only studies I could find that talked about the dangers of being a weekend warrior had an unusual definition. Either they talked about extreme sports (like motocross, rock climbing, skateboarding, hockey, or air- or watercraft related activities)[212] or they are talked about people who did roof or tree maintenance at home on the weekend.[213] It's silly. And it's this weekend warrior fear that probably caused so many people to waste their lives in the gym in the first place. You don't need to live at the gym to be healthy. You don't need to worship the gym anymore. It's a form of vanity if you think about it.

Yeah, but I want to lose weight and look good in a swimsuit...

I think we can all relate to that. Yes, exercising more will burn more calories and can lead to weight loss (but you're also increasing your chance of chronic injury). However, it's a lot easier to just eat less calories. A typical Snickers candy bar (1.5 ounces) has over 200 calories. To burn that you would have to jog for 20 minutes. Or just don't eat the candy bar... Keep in mind, vegetables are the least caloric dense food out there. So they'll fill you up without adding to your weight.

Exercise should be for health and fun, not vanity.

The main point is you can just focus on having a life and having a fun, physically active, adventure with friends every weekend. You'll live just as long and be just as healthy as those fitness nuts. And, if anything, you'll be a lot happier. Isn't that great?

But there is one last thing I have to say: you're still wrong about working out...

You're Still Wrong About Working Out

So if you do something physical on the weekend, you'll be fine, right?

Well, it isn't that simple.

Here's where it all falls apart, exercise and being active are two separate things that *independently* affect your health.

In other words, you can't sit on your butt all day and expect working out, even if you work out a lot, to negate all the sitting you do all day long.

To prove this, we'll be looking at a few different studies.[214][215][216]

I noticed the first study said only women, not really men, were affected. Even then, it was mostly just for cancer. What is going on?

I picked these three studies as I noticed there was one saying, besides all-cause and cancer mortality for women, there wasn't a trend to be found. Instead of ignoring it, I thought I would include it with the others. By comparing the three studies, I think we can easily see that there *is* a trend and why the first one might have said that.

First, let's compare the sample sizes. In order, we have 5,788 men, 7,744 men, and 53,440 men for each study. For deaths and in order, we had 139 die from CVD, 377 die from CVD, and 11,307 die from CVD for each study. So since the first study had the smallest sample size we're less likely to see trends in it clearly.

It reminds me very much of the processed meat versus red meat argument. Both of them harm the body, but process meat is worse. Thus, with a small or poorly designed study it could *appear* that only processed meat does harm. It looks like it was just small enough to keep certain trends from emerging clearly.

And the second study has more than twice as many of deaths to analyze and it looked *specifically* at men and cardiovascular death. They found that excessive sitting gave a 60-80% higher risk of dying. Their definition of excessive sitting isn't high. It consisted of more than 10 hours driving or 23 hours or more of inactive behavior per week (that includes watching your TV or being on your computer). If you have an office job, well, you're out of luck.

However, and even more important, there was a clear trend line showing that *more* sitting meant *more* death, *regardless* of being physically active or not. (Physical activity did help to lessen the trend, as did having a lower BMI, and not having hypertension—avoid the sodium.)

However, regardless of your good health, anything greater than 7 hours in the week (1 hour per day) of driving your car or watching TV started to increase mortality rates (i.e. those two activities *combined* should be below 7 hours for the week or less than 1 hour a day).

Here is another difference in the studies.

The first study looked at sitting at work. The second study looked at time spent watching TV or riding a car. The third study looked at sitting at home.

However, the first study didn't group the data as well as the second and third study. First, for jobs where you don't sit down (manual labor, not office jobs), people tend to be healthier in general. The study even said: "[W]omen and men with standing/walking occupations were older, more likely to smoke, be of a lower education level and social class and have poorer health [...]" So they never really looked at how *much* someone walked or sat, but whether the job was an office one or manual labor one. And we know the culture of many manual labor jobs tend to be unhealthy ones. So if the multivariable adjustment doesn't adequately account for these factors, you won't have good results. I hate to say this, but the first study seems to be not only a small sample size but a poorly designed study as they don't break out the data. They just keep it in more or less two groups, sitting occupations and standing/walking occupations. Plus, standing doesn't have the same benefits as walking.

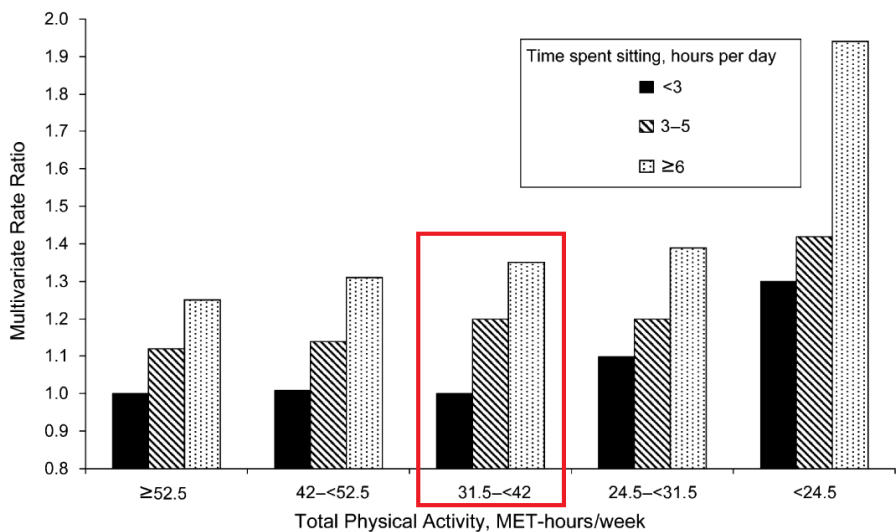
While I understand the more studies the better and that they probably couldn't break out the numbers anymore given the data, I still can't help but be upset knowing that a news article might run a dumb headline saying sitting doesn't matter if you're a guy. It simply isn't true. You need further analysis. Consider for this study that women who had a non-sitting job with high physical activity saw a 50% and 60% decrease in their all-cause and cancer mortality, respectively. Plus, think about sitting jobs for men versus sitting jobs for women, at least in this current time and for the age of the people in the study. 50 years old was the average. Most women of that age in the office would be doing secretary work where they are glued to their computer working on documents. Most men with an office job at that age would walk around a lot more. They get up to talk to a coworker, they go to a meeting, meet a client for lunch, etc. They are a lot more physically active. Now think of a male physical labor job at that age. They drink and smoke more and they are exposed to more industrial chemicals. This would explain the much higher cancer mortality rate for men with a standing/walking job especially when it had low physical activity.

But for further analysis, let's look at the biggest and last study of the three as it looks at total mortality and does a better job breaking out the data. This study also saw an increase in cancer mortality rates for women who sat too much, but not for men. So it agrees with what was found in the small study (even though the small study pulled its data from the United Kingdom and this one from America). Everything is linking together.

(If you're wondering about the high cancer rates for women, while it didn't talk about what cancers caused the deaths, it probably has to do with sunlight. You have non-melanoma (basal cell carcinoma and squamous cell carcinoma) and melanoma skin cancers. While UV light is the main cause of non-melanoma skin cancer it has virtually a 100% survival rate as it doesn't tend to spread through the body (they can just cut it out). Melanoma, however, is the deadly form of skin cancer. While it too can be caused by UV light, you can get melanoma *without* sunlight exposure. Actually, sunlight exposure has been associated with a *decrease* in the rate of death from melanoma.[217][218] Furthermore, it appears that the increase in melanoma rates from sunlight only comes from intense

sessions.[219] In other words, *never* let yourself get sunburned. Again, since women tend to work inside and men outside, it might explain the differences in cancer mortality rates. Personally, I know of a woman who was an office worker who actively tried to avoid the sun, and she ended up dying of skin cancer. There’s a reason why your parents always told you to get some fresh air and sunshine when you were spending too much time inside. Yes, you will wrinkle from the sun eventually, even if you never let it burn you because of the UV rays. However, I think that’s just normal aging. But antioxidants in your skin from eating whole foods will fight that as they’ve been shown to accumulate in your skin.[330] And the red light in the sun seems to heal your skin and prevent wrinkles![329] The red light is proportionally the highest during sunrise and sunset, and that’s also when the UV index is the lowest as well. But you need those UV rays to produce vitamin D in your skin, so be sure to supplement if you’re only going to get the early morning and even sun. And I’m not sure if you’ll get those cancer preventative properties from such a sun exposure schedule.)

Here is a chart from the third study I think you’ll find interesting.



So this is the all-cause mortality rate (lower is better) against MET-hours/week (activity level) with the bars broken out by hours spent sitting per day. If you convert it to MET-minutes you get a range of >3150 to <1470 MET-minutes/week. If you recall, our jogging study had a range of >1840 to <500 MET-minutes/week. What is going on here? Well, the jogging study was looking at working out, but this study is looking at *all* physical activity. You add to your MET-minutes even when you sleep. When it comes to being active, obviously more is better, but even brisk walking whenever you can plus physical activity you normally do in a week will give about 1500 MET-minutes. From there you can add your 500 MET-minutes from working out on the weekend you'll end up being in that middle range of 31.5-42 MET-hours/week (1890-2520 MET-minutes/week). From there, the best way to reduce your mortality rate is to reduce how much time you sit. (Plus, if you aren't sitting, you'll naturally have to do something with a higher MET rating thus adding to your total for the week. Remember, sitting includes sitting on the computer at home, watching TV, or driving your car. We sit a lot more than you think.)

If you want to jump up to that >52.5 MET-hours/week group, you would have to add something like 2 hours of jogging per week (another 1200 MET-minutes). Even then, someone sitting less than you would have a significantly lower mortality rate.

Sitting is the new smoking.

(I should note that the graph above is actually from the women's data. Unfortunately, they didn't have a combined one. As much as I like for them to break out the data, it also needs to be combined at times. The men's followed the same trend, but the women's graph was the cleanest. I don't think the men accurately reported their activity levels as they probably under- or overestimate all the house and yard work they actually do and heavy lifting to help others. I think the situation is very similar to what we saw with the Kitava from Papua New Guinea. Same diet, but the men did more physical labor and were out in the sun more so they had better health markers. Furthermore, this sitting study also said half of the men worked but only a fifth of the women worked. But they did not have data on their occupation activity or occupation sitting practices, so we don't know how it affected the study. Remember how the results from the

first sitting study looking at men's occupations were so unusual, but the second sitting study showed a clear trend for men with sitting and death outside of work? I think we're better off using the women's data here for everyone.)

The study mentioned that this was an older population, so the physical activity they got consisted of walking and gardening. Again, there is a difference between being active and exercising. And being active seems to be the most important thing. Do a dance class. Walk the neighborhood with a friend. Go to that music event. Go shopping at a mall. Do something where you are moving, not sitting. Per the study, try not to sit for more than 3 hours in a day.

If you have to sit at an office chair for hours, take a walking break whenever you can. While the studies never looked at total hours sitting versus total hours of *consecutive* sitting, walking has been shown to activate enzymes in the legs to break down fats and atherosclerosis plaque which might help with health issues. Plus, the calves are known as the second heart as they help to pump the blood up from your feet to your heart as you walk. So a walking break might take some strain off your heart and add years to your life.

If you commute for over an hour to work, it's probably time to move closer or get another job. Plenty of studies show it is the easiest way to improve your happiness (getting a shorter commute to work) or, even better, find a way to walk or take a bike to work.

Hopefully, it's clear to you that working out isn't enough. You need to decrease your sitting/sedentary activities and find ways to be more active in life.

Remember, based off all the studies, no more than 3 hours a day sitting should be your goal (that includes watching TV).

Finally, the studies kept stating that those who sat less were leaner. You did want to look good in that swimsuit, didn't you?

Teeth: A Critical Issue (aka Sugar Is Also Bad for You)

People often ignore their teeth, but it is a critical part of your health. Your teeth and gums appear to play a role in coronary heart disease, our number one killer in men and women in America, and cancer throughout your body.[220][221][222] And it is most likely causation, not correlation, as the same pathogenic bacteria in your mouth are being found in the places where vascular disease is present in your arteries.[243]

So why wouldn't you take care of your teeth?!?

If you take anything away from this chapter, it's this: avoid sugar! White sugar, cane sugar, brown sugar, probably molasses (even though it has a lot of minerals, antioxidant levels, contains a chemical to help with blood clots, and might have some anti-cavity properties that we'll talk about later), and any other processed sugars (there are some special exceptions we'll also get into later). There is no safe minimum (or I guess "maximum" is the right word here) like just trans fats. Sugar is an extract and thus unnatural.

(By the way, you can't eat sugarcane. So that "raw" cane sugar you buy from the store is a processed extract, not a whole food. While chewing on the pulp of the sugarcane plant might have some health benefits from the phytochemicals in the plant, mother nature clearly didn't want us to eat that much sucrose (the sugar in sugarcane) all at once or all the time. And the proof is seen in the cane workers who chew on sugarcane. Even when there is fluoride in their drinking water, they had higher rates of cavities compared to other workers in the field.[244])

Another type of "sugar" to avoid is fermentable carbohydrates. Think of white crackers that stick to your teeth. That starch is actually a chain of sugars. And the fermentable ones will start to break down into sugars in your mouth. Stick to whole grains and stick to the least amount of

processing as possible. Use wheat grain instead of white. Use the intact grain (you can buy whole wheat berries at a natural grocery store) instead of ground down grains (which destroys its beneficial fiber properties) also known as flour.

And make sure to see your dentist regularly. Just how you regularly have your car's oil changed and checked, you should do the same with your dentist. While you can always buy a new car, you only have one body. Don't let your oral health destroy all your other sacrifices (exercising, eating right, getting plenty of sleep, etc.) you make to have a healthy body. Just don't let the dentist over X-ray you (another topic we'll get into more).

Finally, and for the good news, a whole-food, plant-based diet appears to be protective of your teeth. While some vegans do have a higher tendency to get cavities, I believe they are drinking too many fruit juices, cane sugar, and processed vegan foods (reminder, those are *not* whole foods). Whole foods appear to be protective which isn't surprising if you think about the fact that these plants have to protect themselves from pathogenic bacteria as well.

But I'm going to cover some exciting aspects of teeth health, so I hope you take the time to read this chapter as your teeth are a serious matter.

Have You Been Ignoring Your Teeth?

"Conventional dentistry still has a focus on this mechanistic, Newtonian mentality that the teeth aren't connected to the rest of the body. [...] The blood supply in the mouth, literally, will take any toxins, via the lymphatic system, and take it down to the thyroid, thymus, and the heart."

-Dr. Gerald H. Smith DDS, DNM

There is this tendency in those who adopt a more "natural" (however you define that word) or vegan lifestyle to ignore their teeth, myself included. That's a mistake!

While whole foods do seem protective of your teeth and overall health, I'm certain you'll be grateful for the invention of antibiotics if you ever needed one. And you'll also be grateful that they can fill a hole in your teeth if you ever get one.

When I was working at a home improvement warehouse, I heard the story of one of the night crew workers there dying from a hole in one of his teeth. They never saw the dentist about it and just filled it with wax (usually manual labor individuals tend to ignore pains in their body as they see themselves as tougher than most). But I didn't really believe that story until I saw this one in the news:

Tooth infection leads to 26-year-old California dad's death[223]

Even though the man in the story had his tooth pulled and given antibiotics, the infection in his mouth spread and went to his lungs. He left behind a wife and two kids.

This is why you need to stay on top of your oral health!

So how do we protect our teeth from cavities (dental caries as the studies like to call them) and bad gums?

For teeth, it's what your dentist has always told you: stay away from sugar (*processed* sugar)!

Basically, certain bacteria in your mouth turns sugar into acid while sticking to a part of your tooth. And that part of your tooth demineralizes from the acid. Seeing that your teeth are mostly minerals, calcium and some others, that spot eventually turns into a hole, aka a cavity. That cavity can work its way to your pulp and cause all kinds of problems throughout your body. And the bacteria in your mouth can also work through your gums as well to cause you those same problems. So we need both healthy gums and teeth. (And, as I'll prove later, a whole-food, plant-based diet is the best way to prevent gum disease.)

And many modern scholars still agree that the scientific evidence points to sugar as the *only* cause of cavities and that other factors like brushing,

flossing, fluoride, etc. only serve to slow down or speed up the process. [224]

Keep in mind and as I mentioned before, fermentable carbohydrates can turn into sugar while in your mouth. Considering how some of these flour-based products easily get stuck between your teeth, it would explain why sugary cereal is found to be the worst food out there when it comes to tooth decay as you get the best (worst) of both worlds.[225]

(In that study, the cereal with the most sugar did the most damage to the teeth with one exception: Frosted Mini-Wheats. You know, those wheat bricks with that white stuff on one side. And it makes sense as that white stuff is pretty much just sugar that can work its way and get stuck between your teeth. Sugar is the enemy!)

Cane Sugar, Brown Sugar, Molasses, and Honey

What about less processed sugars like cane sugar or brown sugar? While they are *slightly* less cariogenic (*cavity* causing; not to be confused with the word “carcinogenic” which means *cancer* causing) than white sugar, they should be considered pretty much just as cariogenic as white sugar and thus avoided altogether.[226] And I would assume those newer sugars like brown coconut sugar would fall into the same category as well. But let’s see specifically what the scientific literature has to say about various “healthier” processed sugars:

What about molasses?

What makes cane sugar and brown sugar browner than purified white sugar is the phytochemicals, vitamins, and minerals from the sugarcane plant. So if we boost those and decrease the actual sugar in the product, what would happen? There is a process where they boil off the sugar crystals and keep the rest of the stuff. This produces a substance we know as molasses with the third boiling off of sugar crystals producing blackstrap molasses which has the lowest sugar content and highest nutrient content of any molasses. Well, molasses has been shown to

have antibacterial properties activity and thus having some anticariogenic properties.[227] It's anticariogenic because it kills *S. mutans* (*Streptococcus mutans*) and another cavity enhancing bacteria (while various bacteria can cause cavities in your tooth, *S. mutans* is the main one, perhaps only one, to really worry about). But is molasses overall anticariogenic or pro-cavity causing in nature? There seems to be disagreement here in the literature, but the overall advice is to still avoid this sugary food.

What about coconut sugar?

I was able to find one study on coconut sugar. Like all sugars, it allowed a biofilm to form with *S. mutans* thus being cariogenic. However, it allowed an antiseptic treatment later used in the study to kill off more bacteria than the other sugars. This isn't too surprising as it is a brown sugar and has some plant properties. Another brown sugar in the study was Palmyra sugar which interestingly had the least pH change from *S. mutans*, thus the least acidogenic.[241]

Essentially, these brown sugars are healthier than white sugar but not exactly *healthy*. Thus, I can't really recommend them.

What about date sugar?

Unfortunately, I can't find a study on that sugar. It is more of a whole food than the other brown sugars, so I'm interested in how it would perform. I did find one study showing that date extract and date syrup did inhibit *S. mutans* with each stronger concentration of date extract and syrup inhibiting it more and more,[242] but the overall ability of just date sugar to prevent dental cavities is still unknown. And going back to the power of whole foods, you're probably better off just eating dates.

But, overall, it does seem like the more natural the food (except for probably cane sugar) the less you have to worry about cavities.

Honey for example seems to be very good against plaque. Ordinary honey you get from the store has been shown to be more effective than chlorhexidine mouthwash (which the study called the "most effective anti plaque agent [to] date") and xylitol (a very interesting sugar we'll talk

about later) in reducing plaque.[228] Another study showed that Manuka honey reduced plaque better than xylitol chewing gum (but equal to and not better than a chlorhexidine mouthwash).[229] They actually worked the honey into the gum line with these studies. But, remember, that this is plaque they're talking about not necessarily *S. mutans* activity in your mouth. However, there was also an experimental study showing that honey lowers the level of *S. mutans* in your mouth while leaving the rest of the bacteria in your mouth alone (that's a good thing as, just like your gut, you have good bacteria in your mouth you want to keep).[230] So if you must reach for a sugar, go for honey or maybe blackstrap molasses.

(Update: While it reduces plaque, honey has its own bacteria in it that may or may not be bad for existing cavities. See the next chapter for more information.)

Now I did find one study showing that honey was pro-cavity (though much less than all the other sugars tested), *but* they let the honey sit on a tooth for about 21 days! While they did put new honey on it every other day, the antibacterial power of the honey isn't going to last for hours, much less days. But honey probably isn't going to be able to stay in your teeth for even minutes, much less hours in your mouth.[231] (That means you probably should *not* risk eating honey or using it as a kind of mouthwash right before bed.) So, overall, honey is very anticariogenic.

However, this study does concern me as its anticavity power clearly depends on its antibacterial chemicals not getting used up (i.e. it's freshness). So when you grab a vegan bar because it has honey in it, it might still be pro-cavity as the honey is mixed with other ingredients with its own bacteria (bacteria is *everywhere*) that might be using up honey's antibacterial properties while sitting on a shelf. Or if the product is cooked, it might destroy some of honey's antibacterial chemicals. And one of the reasons pure honey is antibacterial is because it is a super saturated sugar and that dehydrates and instantly kills any bacteria that touches it. That means if it's in alone in a bottle, it should be pretty much "fresh" (but do pay attention to expiration dates). But this property is lost when mixed in a candy bar or other ingredients. In short and until we get a study proving otherwise, only use honey straight from a bottle if you're going to

consume it. Of if you're going to mix it with something, consume that mixture right away.

Finally, keep in mind that honey should *never* be used on babies! That's because honey might contain botulism spores (unlike active bacteria, bacteria spores can survive a lot, including honey and your stomach acid). Botulism is a *serious* condition. Typically, this isn't a concern for those 2 years or old.

A Whole-Food, Plant-Based Diet Versus Cavities

So how does the recommendations in this book of whole foods stack against preventing cavities? *Very* well (especially when it comes to your gums). But how does that make sense? Besides certain vegetables, fruit is full of sugar and other plant foods are full of starch. But it goes back to the idea that food is a packaged deal.

Think of it, how on earth can these balls of sugar (fruit) survive in nature unless they had antibacterial properties? They couldn't! And *S. mutans* is a lazy bacteria that can't fight these phytochemicals very well, so they lose to other bacteria in your mouth. This also explains why honey is good for your teeth as well—if all honey didn't have antibacterial properties, bees wouldn't exist.

And the studies back this claim. Raisins, what you would think would be pro-cavity as they are full of sugar and can easily get stuck in your teeth (actually, starchy foods like cookies, crackers, cereal, breads, and potato chips get stuck in your teeth the longest and should be avoided at all costs while raisins only last for minutes[232]) seem to be either cavity neutral or anticavity.[233] Again, raisins, these very sugary snacks, appear to be anticavity or cavity neutral. Crazy!

And if raisins are good for preventing cavities, then so must be grapes. And it was shown that all grapes, despite their various levels of flavonoids and antioxidants levels, equally stopped pH levels dropping from *S. mutans* activity in your mouth and inhibited bacteria's uptake of glucose.

[245] Grapes are, however, more acidic than raisins and thus more demineralizing than raisins. (As I'll show later, grapes are more acidic than most fruits while raisins have a low acidic level compared to other fruits.)

What about apples and all their sugar? Well, while they don't inhibit the growth of *S. mutans*, they prevent them from sticking to your teeth. "Crude whole apple extract has considerable anticariogenic effect on *S. mutans* and hence can be used as a natural alternative which can aid in the prevention of dental caries." [246] Please note that apples are acidic and thus shouldn't be left in your teeth. But it was interesting to see in the study that while lowering the over pH of the mouth to the point of possible demineralization, they did significantly inhibit a further drop in pH levels normally seen with *S. mutans* activity. Remember, they used the *whole* apple. That means apple juice, the stuff you buy from the store, probably has zero anticavity properties and is just essentially sugar water.

Even the dreaded acidic orange (actually, apples are pretty much just as acidic with grapes being more acidic) has anti-*S. mutans* properties. *C. unshiu*, small seedless oranges like tangerines and mandarin, and *C. sinensis*, your common oranges like naval, both worked. But *C. unshiu* did better. [247]

(Before you get too excited about apples and oranges, make sure to see what I have to say about them later as it'll save you from a TON of cavities in the future.)

But what about whole foods in general? What about starchy ones like grains?

While not a vegan study, employees in one of those survivor TV shows went without cleaning their teeth (no toothbrushes, floss, toothpicks, nor any other oral cleaning instrument) while living off the food found on the island. This included grains like barley, wheat, another kind of grain, herbs, honey (their primary source of sugar), milk, berries, and meat. What happened? While they did get more plaque and bacteria in their mouths, they also got healthier gums! But even more impressive is that

the pathogenic bacteria found in tooth decay and gingivitis disappeared!
[234]

(As proven by the above, grains are fine for your dental health, at least if you combine them with other oral healthy things like honey and fruit. Enjoy your oatmeal. Cereal, however, with its processed sugar and its finely crushed grains (flour), is not good for your mouth.)

While seemingly miraculous, this isn't too surprising either as skulls from the Neolithic period (the final stage of the Stone Age) had no cavities. [235] (Please note and as I cited in a study before, these people from preagriculture period were found to have starch in their mouths from grains and tubers.[206] Like the employees of that reality TV show, our Stone Age ancestors hate grains.)

As this paper from the 1950s states: "Dental disease is the almost universal experience of modern man. [...] The increase in tooth decay [...] taking place in the last few hundred years has been widely attributed [to] refined flour and to the eating of large quantities of sugar. [...] Sugar, particularly, has been incriminated, since a rise in its consumption roughly parallels the incidence of decay and its use as an article of diet goes much further back in history than the introduction of refined white flour." And the modern paper I already cited before[224] with many more studies to analyze continues to agree today with this same conclusion from the past. Avoid processed sugar!

So while many in the Paleo community blame agriculture and the introduction of grains as a staple in the diet, this guy points to sugar and flour as being better correlated. This would explain why certain hunter-gatherers from North Africa had rotten teeth as they would turn their wild acorns (storing them over time to increase their sweetness) into a flour, a primitive type of white sugar.[248] Furthermore, sugarcane was one of the first domesticated crops out there and was heavily used before domestication.[249] This better explains rotten teeth than grains/agriculture as whole grains, when you include the outer part of the grains, tend to have anticariogenic properties. I know that oat hulls (the outside part of the oat that is removed) do.[250] It goes, from outer to inner parts of a grain: hull, bran, endosperm, and germ. Your oatmeal is

technically a whole grain because it contains the bran, endosperm, and germ. But should we start eating the hulls of oats as well? I don't know, but a study did have people eat them for a short period without any negative effects.[251] Rice and barley hulls have been shown to have strong anticariogenic properties as well.[319] And people of the past probably just cooked and ate grains with the hulls without thinking about it. But if you're going to eat your oatmeal without the hulls (I don't blame you if you don't), you might want to supercharge it with honey, raisins, and some of the spices we'll be talking about soon.

But Be Careful With Fruits, Especially Apples and Oranges

I remember my parents saying that apples and oranges were a luxury in the past. That they would often only have them on Christmas Day as a present. Today, apples, oranges, and bananas are considered basic fruits you can find anywhere. How times have changed. Why bring this up? Because many fruits (that we didn't eat in large quantities in the past) that are now very common place are very acidic.

Why does that matter?

Do you know how *S. mutans* works to create cavities in your teeth? By producing acid. What do a lot of fruits already have in them? Acid.

Proof?

How about cavities coming from sucking on bananas?[236]

In fact, fruit appears to be just as bad as fruit juice and almost as bad as soda when it comes to demineralizing teeth from its acid content (before *S. mutans* come into effect).[237] This includes grapes, carrots, oranges, apples, tomatoes, and raisins—all were found to be acidic and just as acidic as their juice counterparts.

Wait, I thought raisins were like anti-cavity or whatever.

That's where it gets interesting.

(That study had raisins as the least acidic fruit tested and also showed grapes as the most acidic fruit tested. Tomato juice was the most acidic juice tested with carrot juice being the least. But I would just eat a carrot.)

While all acids demineralize your teeth (whether it is from fruit or *S. mutans*), your teeth remineralizes themselves as well. It does this through your saliva. When it contains calcium, phosphorus, and magnesium and your mouth is in an alkaline state, it pushes these minerals back into your teeth. Actually, toothpaste with these minerals have been shown to help remineralize the teeth[238] (especially when combined with xylitol, you'll see why soon), or if they contain hydroxyapatite[239] (what these minerals combine to make and what makes up the dentin and enamel of your teeth).

(The magic recipe for that toothpaste was calcium glycerophosphate, magnesium chloride, and xylitol. It came from a toothpaste called ROCS Medical Minerals. However, this toothpaste contains glycerin, something we'll talk about later. Or you can buy a toothpaste containing hydroxyapatite, but those tend to be a little more expensive.)

This demineralization from food and remineralization from your saliva is a natural part of life. However, *S. mutans* and other bacteria that demineralize your teeth is harder to fight as it forms little sticky patches on your teeth that protects itself from an alkaline environment and prevents remineralization in that location.

Since raisins and others fruits have antibacterial properties, it kills *S. mutans* and other nasties. As long as your teeth gets a chance to remineralize the "damage" from your fruit, which it should unless you're eating 15 oranges throughout the day or sucking on bananas, you'll be fine. And if you must drink acidic drinks like orange juice, apple cider vinegar in water, lemonade, hibiscus tea, sports drinks, or soda drinks (sorry, but that diet soda seems to be the worst than regular soda at demineralizing your teeth[237]), use a straw!

Okay, but why did you specifically mention apples and oranges in this subtitle?

That's from a personal story everyone should pay attention to. Before going vegan, I ate pretty healthy as a kid: no soda pop and a lot of fruits and vegetables. Despite that, I would always get cavities, especially between my teeth which really sucked. My dentist would always ask if I drank a lot of soda pop (soft drink, cola, whatever you call it in your part of the country). "No," I would answer, but they would shake their head in disbelief.

Finally, I figured it out. I would eat a ton of apples and oranges throughout the day and the acidic pulp would get stuck between my teeth. While I brushed religiously and flossed on most nights, it didn't matter as that pulp was sitting between my teeth for hours on end. So the pulp, I never noticed for some reason, sitting there for hours if not days explained all those cavities. (Just like honey, when fruit is left in your mouth their antibacterial properties get used up. Then all you have left in between your teeth is sugar plus acid, not good.) Even though that happened as a kid/teenage, I'm stuck with these teeth for life. Years prior to these cavities, a different dentist warned me about the decay happening between my teeth and tried to get me on some prescription fluoride packs (I think it was some kind of mouthwash), but I just ignored him and ended up paying the price later. (And he only saw that decay between my teeth because of the X-rays he took, so getting X-rays done on your mouth is important!) Don't make my same mistake! Always take care of difficult problems while they are small. And those new white composite fillings they now use have to be eventually replaced. It's a nightmare.

Do keep in mind that observations studies show that vegan *don't* get any more cavities than omnivores; however, they do get more overall demineralization.[240] I guess most vegans intuitively know to get that fruit pulp out of their teeth right away. I hope you do the same.

So as a word of warning, if you eat any apples, oranges, or any acidic food that gets stuck between your teeth, floss and it out *immediately*. (Oddly enough, berries never seem to get stuck between my teeth.) While they might be antibacterial properties towards *S. mutans*, they can lower the pH level on those spots on your teeth to start to demineralize them! But don't brush them away with a toothbrush as the acidic state your teeth are now in will actually remove more enamel than when you brush

with them in an alkaline state. So use a non-abrasive dental floss (most are) and/or water to get the food out of your teeth. (If you need to keep some floss picks with you when you visit a restaurant, do that!) By the way, you should wait at least 1 hour before brushing after drinking or eating an acidic food like grapes, oranges, or tomatoes.

Other foods like cookies, crackers, cereal, breads, and potato chips, if you're going to eat them, should be removed immediately from your teeth. But a good swish with water and working your tongue over it should do the trick. I've read accounts online that those making an effort to swish with water after eating have low or not cavities to report. Anecdotal evidence, but it highlights the importance of getting food particles out of your mouth as soon as possible.

And Eat Less Frequently

All this advice isn't going to be helpful if you are constantly bombarding your teeth with sugar and acid. Remember, your teeth need time to remineralize.

If you're staying at home doing nothing but eating, you need a new strategy. Stay busy to stay away from snacking (a job is very good for that), eat a late breakfast and an early dinner and don't eat after 8 PM.

Cool, I think I've gotten a good grasp on teeth health now.

Oh, but now we're getting to the fun stuff...

Remineralizing Teeth With Tea, Herbs, And... Sugar?

This section is for those who are having teeth problems and want a little extra help fighting back.

Sugar?

Xylitol. It's a miracle sugar (until a study proves otherwise as it is an extract). Technically, it's a sugar alcohol. It comes from the bark of the birch tree and is found in various foods (like plums, strawberries, cauliflower, and pumpkin[253]). While it is a sugar, the bad bacteria (and us) can't process it. Those greedy bastards get full of it and die of starvation. Our body simply doesn't absorb it. The great thing is it tastes just like sugar! (Like chocolate, never give it to a dog as it can kill them.)

It can be used as a mouthwash and is often used as a nasal spray. Your nose, nasal cavity, mouth, throat, and middle ears (the space behind your eardrums) are all connected and full of bacteria. Xylitol has been shown to help kill the bad bacteria in those places. (You'll notice nasal sprays also use salt, which is also a good way to kill an infection in your mouth and throat as it kills all bacteria and can also be used as a mouthwash.)

Furthermore, Xylitol has been shown to remineralize your teeth[252] (and might help keep your bones from breaking down[254]). It picks up the calcium in your saliva and pushes it into your teeth. Again, it tastes just like sugar and has virtually zero calories as your body doesn't really absorb any of it. It's like sugar's angelic cousin. I'm just surprised they don't make more candies and other sugary treats out of it.

It is an extract, so technically not part of a whole-food diet. So I'm still waiting to find a study showing the harms of xylitol, but so far all I've seen is stomach issues if you have too much. (Like all sugar alcohols, bloating, gas, and a laxative effect are common if you have too much.)

Erythritol is another sugar alcohol that is found in some fruits and fermented foods. It has been used since the 1990s. It also has the ability to kill off *S. mutans* and other bad bugs. It *might* be better than Xylitol in preventing cavities[255] but that seems to be debated about that in the scientific literature as the main study for this claim came from Cargill, the largest privately owned company in the United States and a food company that uses erythritol.[284] I'm not sure if it can remineralize like Xylitol though (based off the bone study, it probably doesn't[254]). And a 2020 systemic review looking at all the available xylitol and erythritol studies said there isn't any good studies on erythritol to draw a conclusion like there is for xylitol.[285] While it probably does work on *S mutans*, it's

probably not any better than xylitol. Also, it is absorbed by the body so you do get some calories from it (but way less than sugar). Like xylitol it might give you stomach issues. And there is a slight cooling aftertaste. Personally, I barely notice it and it is nowhere near as bad as the aftertaste you get from artificial sweeteners.

Finally, there is sorbitol which I wouldn't recommend. While also found in fruits and it clearly can inhibit *S. mutans* [280] (maybe even remineralize teeth based off that bone study), an old study showed 80% of strains of *S. mutans* could still produce acid from it.[281] While it seems to produce less acid than white sugar metabolized by *S. mutans*, helps prevents *S. mutans* from metabolizing white sugar after[282] and the presence of oxygen during the metabolization of sorbitol seems to play a role in decreasing pH levels [283], I would stay away from sorbitol as a new study shows that *S. mutans* does slowly ferment it.[320] So while better than sucrose, it shouldn't really be considered anticavity. Don't use sorbitol.

(And, weirdly enough, you'll find sorbitol as the first ingredient in a lot of toothpastes... I would stay away from those toothpastes as well.)

(Update: So it looks like some bacteria in your mouth, like *Lactobacillus*, can adapt to xylitol and produce acid from it.[333] This is concerning as *Lactobacillus* is found in cavities. You can read more about this in the next chapter. I'm not sure if they can adapt to erythritol or not.)

Stick to xylitol or erythritol when it comes to sugar alcohols.

Speaking of sugar, like I mentioned before, honey can be applied to the mouth directly with great success (don't do it if you have existing cavities). However, I hesitate to suggest you apply a mixture high in fructose and glucose (table sugar is fructose and glucose combined together to form sucrose), especially before bed. As such I would suggest trying these other sugars and methods to help you out.

What about the herbs?

Herbs in general have anticavity properties.

Per one study, in order of effectiveness starting with the most effective one: Java ginger (go look that one up), nutmeg, licorice, cinnamon, peppermint, and regular ginger all showed the ability to inhibit *S. mutans* growth.[270]

And I thought nutmeg was just a worthless spice. (There is a thing called nutmeg poisoning if you take more than one teaspoon worth. Herbs and spices should be treated like... herbs and spices! Just a sprinkle a little on your foods.)

In other words, when I say to eat a variety of whole foods, that includes a variety of herbs and spices too.

So for herbs we have one that has been shown to kill *S. mutans* and remineralize the teeth: cloves.[256] The study looked at clove oil; however, I would suggest just taking it has a tea. Just put some clove powder in hot water and mix.

Neem is another good powder to use. A herbal mixture with neem and clove greatly outperformed both traditional mouthwashes and a xylitol mouthwash in children when it came to plaque reduction.[257]

Cocoa powder, no need for it to be chocolate, has also been shown to reduce *S. mutans* levels in the mouth.[258]

Then there is licorice.

Wait, isn't licorice bad for you?

Yes, if taken in high amounts. Glycyrrhizin (or glycyrrhizic acid) reduces potassium levels which can interrupt nerve function. This can cause an irregular heart beat or even death. Glycyrrhizin is the sweet part of licorice and is about 30 to 50 times sweeter than table sugar. However, glycyrrhizin has health benefits like being anti-inflammatory, an antioxidant, and antimicrobial.[321][322] So glycyrrhizin is why it's good for your mouth, just don't take too much. (And eat more potassium rich foods like fruits and vegetables!)

(Fun fact: that licorice candy you ate as a kid probably contained anise or star anise which has anise oil that has a very similar taste to licorice. Both anise herbs also have antimicrobial properties.)

Licorice extract has been shown to effectively reduce *S. mutans* and thus the number of cavities in children even when given in the form of candy like a lollipop.[259] But, personally, I just take it as a tea. I just try not to drink it every day given the glycyrrhizic acid.

And that brings me to teas.

Tea?

While acidic herbal teas like hibiscus probably isn't good for the teeth (use a straw), green tea is great for keeping pH levels up in the mouth after eating sugar and is great at killing the bad bacteria in the mouth. [260] Plus, it won't harm the good bacteria in your mouth. Amla powder is another great addition to green tea as it'll supercharge it by keeping the bad bacteria from sticking to your teeth.[261] Speaking of combining, combining these various remedies help to hinder the bad bacteria in your mouth. Just how amla powder plus green tea did better than green tea alone, a study showed that green tea plus xylitol did better than green tea alone.[262] It goes back to eating whole foods and eating a *variety* of foods (xylitol does come from a tree you know).

There is an interesting study showing that a combination of xylitol (to push calcium/hydroxyapatite into the tooth), seaweed extract (furoin from *G. furcata*, to kill *S. mutans*), and hydroxyapatite in a gum remineralized the teeth. And the more hydroxyapatite the better. And it remineralized the outer, middle, and inner layer of the tooth enamel.[263]

When you use these ingredients as mouthwash, try to swish them all *between* your teeth. It takes effort but you can do it.

Furthermore, lemon rind/peel and all citrus peels are very good at fighting *S. mutans*. So put a little in your green tea.[264]

Finally, there are probiotics for your mouth. One important one is *Lactobacillus salivarius* (especially K35, K43, and ATCC 11741 strains, a

bacteria often found in saliva as the name suggests)[265][266] which is often found in the mouth of healthy people. It fights *S. mutans* for you. You can buy a general probiotic with it in the ingredients list (there are also probiotic specifically for the mouth or mouth, throat, ears, and nose that contain more probiotics for your nasal cavity health). Open a capsule and swish the powder round your mouth with water or work the powder into your gum line. Don't overdo it as these pills do have other bacteria meant for your gut not your mouth. A few treatments should make a big difference in your plaque formation.

Lactobacillus rhamnosus GG (LGG) has also shown anti-carries activity and is found in many probiotics.[265]

Another option is sauerkraut. The bacteria on it is designed to eat fiber, not your animal gum line. And that bacteria on sauerkraut will fight the other bacteria for control of your mouth. (Some people have reported success with coconut yogurt and coconut water probiotics. But being a sugar fermentation, it would just depend on what probiotics they use to ferment it as to how successful it'll treat your mouth.)

Fermented foods in general are good. *L. plantarum* (a bacteria often found in fermented plant foods like sauerkraut, kimchi, and on plants in general as the name suggests) is very good at slowing down *S. mutans*, like a 70-95% reduction.[267][268]

(Update: Before you add sauerkraut, yogurt, or any fermented food to your diet, see what I have to say in "Teeth: A Critical Issue (Part 2)" as you might be making your cavities worse.)

Finally, you can swish with salt (or salt plus baking soda). But this will kill probably just about everything in your mouth, including the good bacteria. But it's a good idea if you're fighting a really bad infection. (A lower concentration of salt as a mouthwash might save the good bacteria in your mouth as fermented plant foods are often salty, so they are probably okay with a little bit of saline.)

What about coffee?

Good news coffee lovers! Coffee has been shown to inhibit *S. mutans*. It's more of a temporary thing, but it does work. Brewing method (filtered or not, espresso, etc.) doesn't seem to matter. [269]

Just don't be putting sugar in your coffee. And like tea, coffee is acidic, so don't go overboard either.

Now if you have an infection in your mouth or throat, which may or may not be *S. mutans*, freshly crushed garlic kills pretty much everything.

What about oil pulling?

Oil pulling does work, but there is evidence that it does harm to the tooth enamel (and could cause something called lipoid pneumonia). It's probably cause you're swishing oil around your teeth for 20 minutes. But is this enough damage to worry about? Does your body heal it overnight? I'm not sure, but for now I would stick to these other methods mentioned.

But if you're looking into oil pulling, you might be interested in these other ways to save your teeth as well.

(Update: After learning more about various bad bacteria in our cavities, I wonder if oil pulling pulls them out of there. This could explain why people swear by oil pulling.)

Silver diamine fluoride.

Silver fluoride what?

If you have a cavity and can't see a dentist anytime soon, or if you have a black spot that is about to turn into a cavity, silver diamine fluoride might save you. The silver sterilizes the area and the fluoride helps to remineralize it. The fancy way of saying this is it will "arrest dental caries." Furthermore, any exposed dentin will be "twice as hard as healthy dentin." [271] While dentists have easy access to it, it can be hard to find for the average consumer. (It looks like you can only get it through the your dentist, which is probably a good thing.) You can learn more about it through this American Dental Association website: <https://www.ada.org/en/member-center/oral-health-topics/silver-diamine-fluoride>

(Update: Silver diamine fluoride will permanently stain the cavities of your teeth black. Furthermore, it looks like you should expect two-thirds of cavities treated with silver diamine fluoride to be arrested after treatment.)

But if you have a mouthful of teeth going bad, you might be interested in Bioglass.

And what the heck is Bioglass?

Bioactive glass (Bioglass is actually a registered trademark name) is a bone graphing material like hydroxyapatite (remember, teeth are technically bones) but “with anti-infective and angiogenic properties.”[272] Fancy way of saying it’ll disinfect and help teeth to grow. A bioglass like NovaMin will release calcium and phosphorous particles that raise the pH level of your saliva/the tooth it is touching (remember, it must be alkaline to remineralize). Then it will form a hydroxyapatite or hydroxyapatite-like layer over any exposed dentin.[273]

While you can’t buy it at any American local stores (toothpaste is treated as a drug rather than a cosmetic and has more regulations despite your dentist using bioglass on you all the time), you can buy it online as it ships from Canada. There are other bioglasses as well (like BioMin C which creates hydroxyapatite in your mouth BioMin F which creates fluorapatite, a fluoride compound that I’ll talk about soon). You can do the research and find out which is right for you.

While these products aren’t found in nature, it might be what you need to save your teeth.

Finally, you can get dental floss with fluoride in it to fight cavities between your teeth.

While the safety of fluoride in your body is a concern (which we’ll talk about later), there is clear evidence that it hardens your teeth, making it more acid resistant. So if you can control it to go just between your teeth (an area that is an absolute nightmare if you get dental decay or cavities in), it might be worth it for you.

Can We Make a Better Toothpaste?

Do we even need toothpaste?

Well, that study did show those employees on that reality TV show didn't use toothpaste and their dental health got better with simply a healthier diet. But I think overall it is better to brush our teeth. I've heard too many stories of vegans going without brushing only to get many cavities later.

But is there a big problem with current toothpaste?

Avoid glycerin, for the most part

I thought this was an old wives' tale by the alternative health movement, but I found a study suggesting that glycerin prevents tooth remineralization by coating the tooth with a film that is very hard to remove.[274] Until we can find another study proving otherwise, glycerin should be avoided. From the study:

"Glycerin also presented slight decreases in micro-hardness for sound enamel and dentin, similar to the effect of carbamide peroxide [a commercial bleaching agent]. It could act as an adsorbed layer barrier to artificial saliva and [as a barrier] to [the] remineralizing effect."

What is Glycerin?

Glycerin (aka glycerol or glycerine) is a byproduct of soap. To make soap you take oil and combine it with lye. The result is soap and glycerin. Glycerin is slightly sweet and holds on to water and is used as a cheap filler. (And, no, you can't really separate soap and glycerin as many DIY soap makers will complain about glycerin "rivers" showing up in their product that they can't get rid of.)

While many people have suggested brushing your teeth with an olive soap bar instead of toothpaste to avoid glycerin, that would be a very bad idea as it is full of glycerin!

(Glycerin is also found in a lot of foods like candy and gum. Always check the ingredients.)

And most “natural” toothpastes have glycerin as its first or second ingredient.

But glycerin isn’t a deal breaker. As the study I already cited showing that hydroxyapatite in toothpaste will remineralize teeth[239] (it actually shows photographic evidence of remineralization under a microphones), the toothpaste they tested (Biosmalto Caries Abrasion and Erosion) has glycerin as its first ingredient. Same with the ROCS Medical Minerals toothpaste that was shown to remineralize teeth as well: glycerin was the second ingredient with water being the first.[238]

While glycerin does appear to inhibit remineralization (at least in one study using artificial saliva), it doesn’t seem to stop remineralization altogether.

Avoid it when you can, but it isn’t a deal breaker.

Should you avoid fluoride?

What about fluoride in our toothpaste? What about fluoride in our water?

Fluoride in our water is pretty ridiculous as studies continue to come out showing there is a neurological harm like spinal and brain damage[275], especially for children since it can accumulate in the body (especially the bones) over time.[276] While fluoride does work on our teeth and some fluoride is naturally present in our food (like green tea), drinking several cups of it every day is silly and dangerous.

(If you’re worried about fluoride in your tea, herbal tea pretty much has none, but decaffeinated green tea had significantly more than regular green tea in one study.[277] Considering that fluoride is accumulative, drinking only one cup of regular green tea a day as an *adult* should be fine. Also keep in mind, tea grown in soil contaminated with fluoride will have significantly more fluoride. Black tea seems to be much higher in fluoride than green tea. For example, all Ethiopian black tea tested in a study didn’t have safe levels while all tested Ethiopian green teas did and

all imported teas, black or green, were in the safe range.[278] Brewing time also made a difference in fluoride levels. Longer brewing equals more fluoride. So try to get it from a good source and don't buy the generic cheap stuff. You can also look up fluoride levels of various brands online. These fluoride tests are often done by individuals, so take it with a grain of salt. Finally, don't let kids drink tea since their bones are growing, and you should avoid black and green tea if you're pregnant. A slight update to this paragraph after I wrote it and forgive me for not citing any studies as I just want you to know about this, I found out that the mineral boron, besides being good for your overall skeletal health, can help remove fluoride from your bones. It is able to do this because those two minerals compete with each other to get in your bones and your bones are always naturally being broken down and built back up by your cells. But how do we get more boron in our diet? Well, it's suggested that our foods are low in it because of too much agriculture pulling it out of the soil. Actually, it appears the only way you can get enough boron through diet alone is by plant foods, not animal products. You can supplement, but there is concern about taking too much as it can harm you. But not having enough boron in your diet can also harm you. Unfortunately, there is a bit of a debate on how much and how to take boron that I would have to write an entire chapter to properly address it. Since that is well beyond the scope of a book that's supposed to be about basic health (I probably shouldn't have ever wrote that section on iodine), I'll let you research this topic on your own. But if you're looking for a good place to start, try the 2010 paper "Effect of Boron on Human Health" by Sezgin Bakirdere and company, the 2015 paper "Nothing Boring About Boron" by Lara Pizzorno, and Dr. Axe's online article "Boron Uses — Boost Bone Density and Much More" by Jillian Levy. Hint: Like iodine, if you're vegan and eating a *variety* of fruits and vegetables, you're probably getting enough boron.)

Putting it in your toothpaste, however, might be alright as you do spit it out. And fluoride has been shown to kill *S. mutans* through various and complex mechanisms (and it seems to leave *Lactobacillus* alone).[323] But it might harm other beneficial bacteria in your mouth as well since being just a mineral it has no reason to kill one but not the other (many

naturopaths claim the same though I have a hard time finding a study directly proving it). But inhibiting *S. mutans* is *not* the reason we use it.

So how does fluoride benefit your mouth?

Remember hydroxyapatite (HAP)? It's the calcium molecule that your body uses to make up the majority of your enamel and dentin (enamel is the harder outer part of the tooth and dentin is the soft inside bone of your teeth full of tiny pipes). Fluoride takes the mineral in your saliva to form fluorapatite instead which is a stronger molecule more resistant to acid.

But is fluoride really necessary if you are constantly remineralizing your teeth and avoiding sugar. Probably not. Plus you avoid any neurological diseases it might cause and you can still get a small amount in tea, and my guess is tea probably has compounds to protect you from the dangers of fluoride as we often see with plants that are regularly exposed to certain toxins.

Finally, hydroxyapatite has been shown to be just as effective at remineralizing the teeth as fluoride.[279] There was no difference in remineralization amount or lesion depth. While the remineralization portion of your tooth won't be as hard as fluorapatite, your tooth won't remineralize any more by using fluoride.

(The two toothpastes tested were Germany ones: Kinder Karex Zahnpasta (Karex Kid's toothpaste) with 10% microcrystalline HAP and Elmex Kinder Zahnpasta (Elmex Kid's toothpaste) with 500 ppm fluoride as amine fluoride. The Karex paste contained glycerin as its third main ingredient and xylitol was listed after Hydroxyapatite. Elmex contained no glycerin but had sorbitol as it's filler/main ingredient behind water. Considering what we know about sorbitol and glycerin, take this study with a grain of salt.)

But at a minimum, don't drink fluoride in your water (use a charcoal filter to reduce the amount in your tap or use bottled water).

DIY Toothpaste

So what should you do to avoid fluoride and/or glycerin?

You can make your own. After looking online, I've found a toothpaste recipe and a tooth powder recipe that both look promising:

DIY Toothpaste (from Kathleen Hawk's YouTube video "What Happened After 4 Years Using DIY Toothpaste - My Experience"):[331]

- Calcium carbonate powder
- Coconut oil
- Baking soda
- Trace mineral powder
- Peppermint essential oil

The coconut oil acts as a filler, since there is no glycerin, to make it somewhat of a paste.

(Update: Bentonite clay seems to be a good alternative to coconut oil to bind it together as a paste as coconut oil can go bad being a fat. You just have to put more bentonite clay/mud in it to make it more of a paste rather than a powder. But I talk more about bentonite clay below.)

She claims the first version of her DIY toothpaste (without the calcium or trace minerals) actually demineralized her teeth and showed pictures of her teeth becoming more clear over time. But she claims once she added the calcium and trace mineral powder, she was able to reverse it. Apparently, we need some kind of mechanism like trace minerals, magnesium, or xylitol to push calcium into our teeth.

If you wanted to potentially upgrade this formula, you could use hydroxyapatite powder instead of calcium (often sold as calcium hydroxyapatite online) and xylitol.

DIY Tooth Powder (from The Wellness Family's YouTube video "DIY Tooth Powder: Zero Waste, Cheap Alternative to Toothpaste (Fluoride & Glycerin Free)"):[332]

- Bentonite Clay
- Baking Soda
- Sea Salt
- Activated Charcoal

- Cinnamon
- Clove
- Organic Stevia
- Peppermint Leaves
- Peppermint Essential Oil

You just get it wet and brush away. No need for filler as it is a powder instead of a paste.

Bentonite clay and a Celtic or Himalayan sea salt will contain trace minerals. I'll let you visit these YouTubers' videos to get the exact recipe. And they would probably appreciate it if you used their affiliate links as well.

(Update: One thing found in alternative toothpastes to remineralize teeth is diatomaceous earth as it contains a lot of silica. However, it can be dangerous to get in the air as it is sharp at a microscopic level and can damage your lungs. Basically, you want to get it and keep it wet. And make sure to get the food grade. Unfortunately, no studies exists to show if it works or not on teeth. But I have seen a lot of personal accounts online that it does.)

What about charcoal?

Like glycerin and fluoride, dentists are worried about all the charcoal now being found in our toothpastes. While they can't name a negative, they simply say we don't know the possible negative effects since it is a new ingredient. But I think I found one: a study used a charcoal treatment on teeth to remove the beneficial polyphenols from teas and food extracts. [286] These same polyphenols inhibits *S. mutans*. While the jury is still out, for now I would recommend avoiding charcoal and not using it in the DIY tooth powder formula above. Perhaps it's fine in a morning brush if you start eating healthy right after, but you should at least avoid it before you go to bed.

But bentonite clay, and probably all clay in general, also has chemical absorbing properties. So it too might absorb all the beneficial polyphenols you get from your foods throughout the day that work to prevent *S.*

mutans for forming cavities on your teeth. It is claimed on many websites that bentonite clay also releases minerals like iron, magnesium, calcium, potassium, etc. while absorbing toxins. True or not, they aren't the same as polyphenols that protect your teeth. (But then again, it might absorb away any glycerin left on your teeth.)

So in general, it seems like bentonite clay *might* be better than charcoal powder (activated or not, activated means it is more porous). However, it seems like the DIY toothpaste formula above might be the better option than the DIY tooth powder and to just use a trace mineral powder or salts with trace minerals (like Celtic or Himalayan) instead of bentonite clay to get your minerals.

But if you don't want to make your own toothpaste...

If you don't want to be making your own toothpaste, Redmond Earthpaste is a good choice. While their ingredients do change from time to time, it mostly just contains water, clay, sea salt, and peppermint oil. And I've used it myself, and it works. It's a different kind of clean, but my teeth feel more natural. Maybe that's because it's allowing my teeth to remineralize instead of having that artificial slickness that glycerin gives to your teeth.

Wait, Redmond clay is bentonite clay. Should we be using this toothpaste?

That is true. So I would recommend, especially if you are using it at night right before going to bed, to swish your teeth with green tea right after. Fill your mouth with polyphenols that fight *S. mutans*. And, remember, you can supercharge green tea by adding things like xylitol and amla powder to it. While there are a few food options to choose from, green tea also has a little bit of fluoride and minerals as well. Keep in mind that green tea is slightly acidic, so don't go overboard. Swish it just enough to coat your mouth and get it between your teeth. And you might want to drink a cup of water *before* you do your green tea mouthwash as your saliva will naturally re-alkaline your mouth. Water will help make sure you are hydrated before bed and producing plenty of saliva so you don't end up developing a dry mouth.

Another option, going the opposite way, is to use baking soda as a mouthwash before bed. It is alkaline and has been shown to prevent the growth of *S. mutans* for up to at least 42 hours.[287] While it didn't kill *S. mutans*, it allowed for zero growth of the bacteria while in a sugar solution. That's very impressive. They used equal amounts sugar water (10% sucrose), *S. mutans*, and baking soda. Seeing that there should be very little sugar in your mouth after brushing, you probably only need a little bit of baking soda in water to mimic the same results. Also, I wouldn't combine baking soda with green tea as you're now combining an acid with a base, which will result in new chemicals that probably do nothing against *S. mutans*.

And keep in mind that your mouth needs to be slightly alkaline to remineralize. However, this baking soda might inhibit or even kill some of the good bacteria in your mouth.

What about using honey before bed?

While honey appears to be excellent at killing *S. mutans*, taking it before bed might be a *really* bad idea as the antibacterial properties might be used up after an hour or sooner leaving just sugar on your teeth all night long. But in the morning and throughout the day, you're probably better off by consuming honey (as long as you aren't a newborn) when it comes to dental health.

But I'm okay with a glycerin-based rather than clay or coconut oil based toothpaste. What are my options?

I've heard good things about Dr. Bronner's All-One Toothpaste. It is sodium lauryl sulfate and foaming agent free (foaming agents in toothpastes have been shown to irritate your gums and mouth and don't appear to remove any more plaque than toothpastes without it).[324][325] A woman online claimed she hasn't had cavities for 10 years. She says she uses this toothpaste because it is fluoride free (as she claims the fluoride kills the good bacteria in your mouth), eats a lot of naturally fermented vegetables like sauerkraut (which will have various good bacteria we talked about earlier), and consumes foods high in vitamin D

and A like cod liver oil and butter concentrate. No, she wasn't vegan, but what she did obviously worked for her.[288]

If you want both a glycerin and fluoride toothpaste, unfortunately, you're on your own to figure that out. While just about all commercial toothpastes will have both, there are too many other ingredients to research for me to say which one is safe for your overall health. And while just about all "natural" toothpastes out there will contain glycerin, probably none of them will contain fluoride.

What about no toothpaste at all?

But if you really want to experiment with your oral health, there is a well known periodontist who claims he doesn't use any toothpaste, just a toothbrush and other oral cleaning tools like floss picks/interdental brushes and probably an oral irrigator (aka a water flosser). And he'll show you the germs that are or are not there under a microscope. You can see his work at his YouTube channel titled: "Joseph R Nemeth DDS & Associates" and decide for yourself.

Dr. Nemeth also appears to have changed his mind on fluoride after reading studies on the dangers of it. This includes a study showing that countries with fluoridated water have no less cavities than countries with non-fluoridated water.[289]

Keep in mind, as Dr. Nemeth says, the most important thing is that you *thoroughly* clean your teeth, not what toothpaste you use if any at all.

Good, I think I now have a solid basis when it comes to oral health to start making decisions for myself.

Wait! There is one last piece of the puzzle...

Dentists, Should We Still Visit Them?

Dentists, should we visit them? Yes!

But X-rays are harmful, and they're aiming them at your brain!

Well, that is a good point, but you have to weight the benefits versus the harm as a rotten tooth can ruin your life. (Update: Dentists now use digital X-rays, which is much less radiation than the traditional film ones.) I would suggest you take a look at the documentary Root Cause (2018/2019) when you get a chance. (While it is a professional documentary, it's not a family-friendly/kid-friendly documentary as there is some skimpy outfits here and there and a topless woman in one scene. Again, it is a very professionally done documentary, but a word of warning to those with a family. Speaking of kids, those are probably the individuals we should protect from X-rays the most. Those kids who got intense dental X-rays were much more likely to develop brain tumors at a later age.[326] That means asking your dentist to do fewer X-rays on your kids.)

The film Root Cause basically shows that root canals leave deadly bacteria in that tooth that can affect all parts of your body, including your heart. Furthermore, if your wisdom teeth were improperly pulled, you could have a pocket of bacteria in your jaw eating away at your health.

What the film suggests is going to see a holistic/biological dentist who will use new concepts and technology in treating you like a 3D dental cone beam scan (a type of CT scan to produce a 3D image of your teeth) to better spot tooth and gum infections, ozone injections (to sterilize the area), vitamin C injections (to neutralize the ozone)[290], pulling teeth instead of doing root canals, and using zirconia implants and/or bridges that don't use crowns.

(Update: Zirconia might be too hard of a material to go in your mouth as an implant or crown. I prefer ceramic, especially Emax. While you might have to get them replaced decades or even years down the road, they probably won't damage/wear down your opposing teeth. Zirconia, on the other hand, will probably last you forever, like a diamond (and cubic zirconia is sold as the world's most popular diamond imitation), but might damage your teeth in time. Plus, X-rays can't penetrate them, so you won't know if something rotten is happening beneath a crown. Speaking of crowns, I also suggest a partial crown when possible instead of a full, but you'll learn more about that in the part which covers biomimetic dentistry.)

But back to X-rays, yeah, they're bad for you. The American Dental Association even recommended doing less than the traditional X-rays twice a year.[294] You'll need to talk to your dentist about doing less of them or ask to be seen only once a year instead of the traditional biannual appointments.

(By the way, that 3D dental cone beam scan is 95% less radiation than a traditional CT scan, but still more than the X-rays you normally get at a dentist office. So that's also something you don't want to get if you don't have to.)

Fasting before getting ionizing radiation (like X-rays) does help to protect your DNA damage. So that's something you could do with these X-rays. (Calorie restriction also seems to work but only if you do it both before and after the X-rays—with fasting you just have to do it before.)[291]

But an easier way is to increase the antioxidants in your body. How? Eat whole foods. While two cups of lemon balm tea a day reduces the damage done by X-rays,[292] but a lot of whole foods do the same. Airline pilots, who are exposed to more ionizing radiation due to being higher in the sky where the atmosphere can't protect you as much, who ate more antioxidant foods had lower oxidant stress in their bodies compared to other pilots (and antioxidant supplements did *not* work!). [293] And of those pilots guess who were the most protected? The ones who ate a *variety* of whole foods (but for those who limited their plant foods to one category, leafy greens did the best).

Sure, fasting with some lemon balm tea will do you good, but certain antioxidants in your body can take a long time to accumulate. That means you should start eating healthy *now* if you're worried about X-rays from the dentist.

Finally, you can just decrease the damage done by X-rays by decreasing the amount of X-rays you get. Like I said before, instead of having them done twice a year, have them do it once a year. You just cut your exposure by half! Does this go against modern dentistry? No, it doesn't. Remember, the American Dental Association says to not get X-rays all

the time because of the damage.[294] And you can probably get away with getting less X-rays done if you cut down on the sugar!

Still, regularly go to a dentist!

You can't probably cut your own hair with scissors without a mirror, and it's still better to have someone else do.

You don't know how your teeth are really doing until you get an X-ray and have a professional look at them.

But some X-rays are natural. If you had a Geiger counter with you right now, you'll see you're getting hit anywhere from 20 to 50 X-rays a minute, even if you were out in the country. So don't be too scared of them.

But do be careful who you visit. A lot of dentists will blast you with a hundred X-rays to show off their technology and pictures of your teeth to make you think they're the most thorough and accurate to get you to spend your money on them.

While there are honest dentists out there, dentistry is a business. So you should take what they say with a grain of salt.

(Update: So I went to a dentist after implementing all the stuff in this book and... my teeth got worse. A lot of precavities became cavities. **(2nd Update:** I figured it out. See the next chapter: "Teeth: A Critical Issue (Part 2)" for the answer.) And, no, it wasn't my vegan diet as when I first saw them after 10 years of not going and being on a vegan diet they were impressed it wasn't worse. But my follow-up appointment wasn't good. Bad genes? Maybe. I know I do snack a lot. Since I was a child, my dentists would always ask: "Do you floss?" Yes, I would answer. "Do you drink soda pop?" No, I would say. They would shake their heads in disbelief. But I think my frequency in eating is the main culprit (as bad genetics is turning out not to really be a thing or as big of a factor when it comes to health). My mom always had a ton of "healthy" food that was full of sugar, carbs, and acid, and I would always snacked as a form of entertainment. By the way, the eating and socializing reward parts of your brain are the same. So socializing can keep you from snacking all the time. (A good reason to get a job outside the house.) Remember, you

have to give your teeth time to remineralize. And once you get a cavity, there is no fixing that without a dentist (very new cavities can remineralize, but it's a toss up if they will... just look at my situation). Also, I would frequently put apple cider vinegar and lemon in my water. Even when I drank it through a straw, some of it would hit the back of my teeth, and that's where I have most of my problems. Or maybe I over did it on the honey and flour products like chips and bread... I don't know. Heck, maybe those spots were too far gone to ever be remineralized. But my bet is I was over snacking. After I took snacking out of the equation (I moved out on my own), I've lost a lot of body fat and that was after being on a mostly plant-based, whole-food diet for 10 years that supposedly keeps you skinny. So, yeah, I was probably snacking way too much. Take that information as you will. But I would certainly see a dentist on the regular.)

What About Your Gums?

Good news, that's where a whole-food, plant-based diet kicks the most butt.[327] Basically, more vitamin C equals better gums.[328] And fruits and vegetables are where you get your vitamins.

Well, I can just supplement.

I wouldn't do that. Besides the phytochemicals also being helpful in protecting your gums (like lycopene), these phytochemicals also prevent vitamin C from becoming a pro-oxidant after being used to quench another pro-oxidant (a less damaging oxidant but still damaging).[295] That's probably why supplementation with vitamin C has made people worse off when it comes to cardio health.[296]. But lemons, oranges, and just about all fruits have phytochemicals that prevent that. It's the best way to get your vitamin C.

(Remember, besides B12 and vitamin D you should get all your vitamins and minerals from whole foods.)

Even though they tend to be acidic, you need these foods high in vitamin C for healthy gums. And that's why vegans tend to have great gums.[297]

Conclusion

That's pretty much it. A whole-food, plant-based diet is fine for your teeth. While, yes, more acidic than an omnivorous diet, that doesn't necessarily mean more cavities, especially when you consider all the antibacterial properties of those whole foods. Just don't let the food particles sit on your teeth. (If you have to bring dental floss or floss picks with you to restaurants, do it!)

But the main culprit is, and always has been, processed sugar (and to a lesser extent flour). So don't be one of those vegans that juices all their fruits and vegetables (no longer a whole food when you do that) and then adds cane sugar to it. That's just ridiculous!

(Remember, cane sugar isn't a whole food but an extract. Avoid extracts!)

At the very least, stay the heck away from white sugar and white flour. But even better is to go to the opposite side of the spectrum and stick to whole foods. As long as they don't get stuck between your teeth, they can't harm you.

Your body is made for *whole* foods.

So stop it with this sugar garbage, brush your teeth, get those food particles out of your mouth, and go see your dentist!

Teeth: A Critical Issue (Part 2)

I've learned a few more things that you'll really want to know (it'll be short, I promise... well, except for the *Lactobacillus* part as it threw a curveball.)

A better dentist

You should know about holistic dentists by now, but there is also something called biomimetic dentists. Biomimetic means to mimic nature. So a biomimetic dentist will leave as much tooth as possible (avoiding crowns and root canals as much as possible and even leaving a little bit of decay under a filling as they know It'll remineralize). They also try to replicate teeth when possible. How? The inner part of your tooth (dentin) is actually soft and will give a little, this helps to keep the harder outside (enamel) from cracking. So biomimetic dentists will do your fillings in layers with the bottom layers being more flexible like your real teeth.

I bring this up as all the traditional dentists I saw said I needed a root canal despite passing the cold and percussion test (that meant my tooth was still alive). Only a biomimetic dentist was willing to crown it without a root canal. A holistic dentist would have pulled the tooth and replaced it with an implant. While better than a root canal, I hear that implants of any kind (joint or tooth) tend to harbor bacteria as your immune system tends to have a hard time getting there.

So the real diamond in the rough would be a dentist who is biomimetic and holistic. But I should warn you, some dentists are that in name only. I guess they think it'll get them new customers. As always, you'll have to do your own research to find a good one.

But the most important thing is to see a dentist regularly (biomimetic/holistic or not) so that you're not in a position of needing a root canal in the first place.

More about cavities

I also learned more about the cause of cavities.

While I know I put a lot of focus on *S. mutans* in the prior chapter, biopsies of cavities showed a range of different bacteria in them, in different ratios, even when sampling them from the same mouth.

So what is going on here?

While *S. mutans* is the initial drill to break open your tooth, ALL the bacteria in your mouth (good or bad) wants minerals to eat. Like us, they need a variety of nutrients to be healthy. This might explain why my cavities got worse despite eating foods that kills *S. mutans* like fruit and honey as I might have been feeding the other bacteria in my cavities the sugar it needed to stay in there. The moral of the story: go see your dentist and stay on top of your oral health!

Saliva

I also learned that saliva has antibodies in it that will attack bacteria it identifies as bad with hydrogen peroxide. While you should know by now that saliva is alkaline which helps to fight the acid nature of foods in your mouth and it has minerals that help to remineralize your teeth, the antibodies play a role in keeping bad bacteria out of your mouth. This is why many dentists suggest chewing every so often with a sugar-free gum as it'll help to get saliva going on your mouth.

Oral probiotic are bad (the problem with *Lactobacillus*)?

Keep in mind, the antibodies in your saliva does not attack good bacteria. So when a bacteria like *Lactobacillus* (yes, the probiotic good for your gut) is in your dental caries, your saliva won't attack it. However, *Lactobacillus* (certain strains at least) might be good for your oral health, including preventing cavities (as it fights *S. mutans*). The science seems to disagree on whether it is an opportunist bacteria or a beneficial bacteria. I think it is best to err on the opportunist side unless you are certain about a strain you're taking.

Lactobacillus is found in fermented foods like yogurt, cheese, sauerkraut, pickles, kimchi, kefir, and many gut and even probiotics. So stay away if you have cavities.

And some of the *Lactobacillus* found in cavities (*L. plantarum*, *L. rhamnosus*, *L. casei*, and *L. salivarius*[344]) were some of the ones I recommended in the previous chapter!

This might explain why my cavities got worse (got bigger and jumped to another tooth if the cavity was touching it) as I consumed a ton of sauerkraut and yogurt thinking it was good for my teeth.

(One study showed consuming dairy yogurts have been shown to decrease both *S. mutans* and the *Lactobacillus*, more or less all strains of it, in your mouth.[342] However, almost all yogurts you'll find are made with *L. acidophilus* which has also been found in dental caries.[341] So I find that odd. It appears that *L. rhamnosus*[343] (maybe *L. casei* as well) is killing and replacing the other *Lactobacillus* in your mouth when you eat dairy products. But as I just mentioned, both have been found in dental caries. I know some tooth powders you can buy on Amazon says to brush with it using a yogurt and to leave the yogurt in your mouth overnight. While probably good for reducing *S. mutans* in your mouth, it is most likely a bad thing to do if you already have existing cavities.)

But, remember, a woman went 10 years without going to the dentist and had no cavities. She said she religiously ate fermented sauerkraut (the kind you buy at Whole Foods in the refrigerated section, so full of bacteria). But she probably never had *S. mutans* make that initial hole for *Lactobacillus* to get in. And the science seems to back this up.

According to Wikipedia (cause I'm get too lazy to pull up and read all these studies as this book continues to grow in length):

Some lactobacilli have been associated with cases of dental caries (cavities). Lactic acid can corrode teeth, and the *Lactobacillus* count in saliva has been used as a "caries test" for many years. *Lactobacilli* characteristically cause existing carious lesions to progress, especially those in coronal caries [cavities on the crown of the tooth]. The issue is, however, complex, as recent studies show probiotics can allow beneficial lactobacilli to populate sites on teeth, preventing streptococcal pathogens from taking

hold and inducing dental decay. The scientific research of lactobacilli in relation to oral health is a new field and only a few studies and results have been published. Some studies have provided evidence of certain *Lactobacilli* which can be a probiotic for oral health. Some species, but not all, show evidence in defense to dental caries.

So what I take away from that is to avoid *Lactobacillus* and fermented foods while you have cavities. But consuming them in moderation while you don't can be a good way to prevent them.

Finally, if you think you have a cavity with *Lactobacillus* in it, remember fluoride doesn't kill it.[323] Furthermore, it has been shown to adapt to and produce acid from xylitol[333] (erythritol and sorbitol also seem to have no effect)[284] and it produces its own hydrogen peroxide to kill other germs (so it is probably somewhat immune) and the antibodies in your saliva probably won't attack it. Even extremely strong natural remedies, like Holy Basil [334], seem to have no effect on *Lactobacillus*, if anything it preserves it. If you need to disinfect a cavity, consider the silver diamine fluoride (SDF) I mentioned earlier (silver kills pretty much everything) or putting iodine on it (iodine also pretty much kills everything). Be careful with these disinfectants as the last two are strong. You just want to put it on the cavity itself and remove the excess. Both will tend to darken the teeth, SDF for sure will stain the cavity black and it's *permanent*. (It makes me wonder if all that colloidal silver found in "natural" toothpastes will stain your cavities black over time as well.)

(But it looks like, oddly enough, potassium iodide, might be able to mostly reverse the black stains from SDF if applied right after.[335])

Lugol's Iodine can easily be found online. (I would NOT consume it as iodine supplements seem to be linked to thyroid cancer. Remember, get your nutrients through whole foods.) The silver diamine fluoride, however, I couldn't find online. (You'll find a lot of fluoride varnish online, but that's not the same thing as all it might have is xylitol and a type of calcium, so no true disinfectant.) I would suggest you call around as dentists can order it from their catalog (ADA dental billing code is D1354, D1208, D9910, D1999 and the brand often purchased is called AdvantageArrest).

As I said, you'll have to call around as most dentists will probably just want to drill you and bill you. I think the cost of application at the moment is between \$20 to \$40 per tooth or about \$80 to \$100 with them doing everywhere in your mouth that appears to need it. But, again, it'll turn your cavities black. For this reason, it is often used on low income families who can't afford to fix all their child's cavities.

Anything else we can do... I don't want black teeth?

I thought about honey. Remember, all those studies showing it being more effect than mouthwash in killing bacteria? But it turns out even honey has it's own bacteria (*Bifidobacterium* and *Lactobacillus*).[336] Specifically, it has *L. acidophilus* (which, honestly, isn't clear if that species contributes to caries or not but it is found in cavities at a low percentage at about 8%).[337] One species, *L. Brevis*, was found in 25% of cavities while *L. salivarius* and *L. gasseri* as only found in 1.5%. [352]

However, bee propolis (a bee glue) has been shown to decrease *Lactobacillus* and increase *Bifidobacterium* in bee guts.[338] Propolis has been shown to help arrest caries and improve gum health.[339] Actually, it is often used by the alternative medicine crowd to improve gum health. So it should be safe.

Furthermore, bee propolis limited plaque formation on the tooth and "decreasing the tolerance of microorganisms to low pH and slowing down acid production." [345] This means *Lactobacillus*, which produces lactic acid, is going to slow down, stop, or even die. This is supported by another study showing that bee propolis disinfected both *S. mutans* and *Lactobacillus* in dental caries as well as a disinfecting laser.[346] Finally, the studies show no known side effects with bee propolis.[345]

But I still somewhat hesitate to recommend anything more natural since xylitol and honey betrayed me. Don't get me wrong, those two are still great if you don't have cavities to prevent cavities. Like honey, bee propolis probably has its own bacteria in it to worry about. While I'm not sure if it carries *Bifidobacterium*, it has been shown to increase it in bee guts and *Bifidobacterium* has been found in dental caries (especially *B. dentium*). [347] However, "*Lactobacillus* is considered the second most

cariogenic bacteria of oral flora” so you’ll probably still better off with it or at least using it a few times.[348] But then again... “Oral *Bifidobacteriaceae* [*Bifidobacterium*], having both acidogenic and aciduric characteristics, can play a relevant role in the progression of dental caries, including root caries. These organisms can routinely be isolated from lesions associated with dental root caries using appropriate cultural methods.”[353] So they’re associated with root caries, older people tend to get more root caries (as the roots of their teeth get exposed more), and higher levels of *Bifidobacteria* and yeast in the mouth correlated strongly with age (i.e. older people had more of it in their mouth).[354]

So I would guess, just a guess, that it is best to use it on coronal caries and not on root caries. While bee propolis is routinely used on receding gums, the type of bacteria that causes receding gums is different than what causes cavities. Plus, like *Lactobacillus*, *Bifidobacterium* probably doesn’t harm your teeth unless there is already a cavity there.

Okay, done with bee propolis. Let’s look at something else.

Another idea is garlic. It is very effective against both *S. mutans* and *Lactobacillus*. [340] It is best if you get a fresh clove and cut or crush it (it’s what activates the chemical that kills germs). Press against the cavity to get the garlic juice on it. Don’t leave the clove in your mouth as it is full of prebiotics, which could feed the bacteria in your mouth once antimicrobial chemicals are used up. (Garlic is also excellent for receding gums as it is caused by bacteria. I’ve had great success with it.)

Finally, if you want to stick to traditional dentistry (I’m a little burnt out and disappointed with the alternative dentistry as well), you can use a chlorhexidine varnish on your teeth. It’s like fluoride varnish. A study showed that 1% chlorhexidine and 1% thymol (an oil in thyme) varnish was as effect as a 10% fluoride varnish when it came to remineralizing cavities.[349] Of course, I don’t see why you couldn’t use both (just don’t use a varnish containing xylitol) or a fluoride mouthwash.

Chlorhexidine varnish (at 10% concentration) is very good for treating root caries (40% reduction of them) but not so much for coronal caries (about

15%).[350] While chlorhexidine varnish was effective in remineralizing cavities, it was not effective in preventing cavities.[351]

So that's *Lactobacillus* for you. Definitely a curveball, but something to be mindful of if you already have cavities in your mouth.

But regardless if it and other bacteria is good for our mouths or not, you can benefit by keeping the overall number of bacteria in your mouth low by brushing your teeth, not having food particles in your mouth, and, of course, avoiding the sugar.

When to remove fluoride

So I've come across people claiming that teeth get used to remineralizing with fluoride and once removed your teeth has a hard time remineralizing. They back this claim by saying they got a ton of cavities after removing fluoride-based toothpaste. There might be some validity to their claim or it could be they eat so many carbohydrates, especially white sugar and flour, that their teeth were being protected by the fluoride.

Either way, I don't think it's a good idea to remove fluoride if you have existing cavities. Wait until all your cavities are gone before you stop using a fluoride toothpaste or mouthwash as fluoride has consistently been shown to help remineralize spots of demineralization (prevent them from becoming cavities).

The best toothpaste?

Yeah, so with xylitol and other more natural remedies (e.g. yogurt based toothpaste) kind of disappointing me and with commercial toothpastes often containing sorbitol (which isn't good either) and other junk, I'm starting to think Dr. Nemeth might be right in using no toothpaste at all.

But I would add this: floss, maybe use a interdental brush as he recommends, and use a waterpik, especially if you eat grains.

(And if you're coming off a fluoride toothpaste or have demineralized spots, use a fluoride rinse after like ACT.)

I have tight teeth. I'll floss and wash with water to spit out food particles. Then I'll use a waterpik and still spit out even more food particles. I didn't have that problem when I ate carnivore and what I keep spitting out was mostly from grains.

And, I would use a disclosing tablets once in a while. You know the pills that color your teeth to show you where plaque is. It'll give you an idea how to brush better to get all the plaque.

Finally, I wanted to say that I tried almost all those techniques I recommended in the previous chapter. I made a DIY toothpaste with hydroxyapatite and xylitol to remineralize my teeth. But then I noticed I started to get a little bit of tartar/calculus on my front lower teeth (where my saliva naturally pools). I finally found a bioglass toothpaste online, and then noticed tartar with another tooth after using it (if you think you have tartar, go to your dentist to know for sure as you might be confusing it with the root of your tooth). And, remember, my cavities got worse.

Thinking about the rest of the suggestions in this book (getting your nutrients through whole foods instead of supplements), I think it's a mistake to play God with all these chemical ingredients. It's best to keep them clean and get out of their way. I would avoid this exotic stuff and stick to the basics. Your teeth know how to take care of themselves.

Speaking of which...

Why don't vegans get more cavities?

Finally, I think I figured out how vegans can have more demineralization from their diet but no additional cavities compared to other dietary groups (besides the anti-*S. mutans* ability of their foods).

As you know, your saliva remineralizes your teeth from the outside, but your teeth are also remineralizing themselves from the inside. Your teeth, going from the outside in, consist of enamel, dentin, and pulp. Your enamel is the hard cover (the hardest substance in your body as you've probably heard before). Your pulp brings in the blood and nerves. But the dentin in between, however, is kind of special. It too is hard like bone (but softer and more flexible than your enamel as it has collagen), but it has

an almost countless number of tubes linking the pulp to the enamel. The fluid in these tubes is alkaline, full of minerals, and is pushing out on your teeth. This outward pressure is important as, despite being the hardest substance in your body, your enamel is porous. So this outward pressure helps to keep acid and bacteria out of your teeth.

I found that very interesting and figured if you made it this far in the book you would want to know as well.

So a vegan diet, with its alkaline promoting, circulatory promoting, and anti-inflammatory properties, probably helps vegans to remineralize their teeth faster from the inside out compared to other diets. That also means staying healthy in general will probably help keep your teeth healthy as well.

But do you know what causes the fluid in your dentin to create pressure in the other direction, essentially sucking bacteria and acid into your teeth? Sugar! Processed sugar at least. Stay away from the sugar!

That's it. Just a little bit more of an update for you guys. On to the other stuff!

Teeth: A Critical Issue (Part 3)

This is a slight but important final update.

Cleaning your teeth

After searching the Internet for more advice, I was blown away by one YouTuber: Baseline Dental. He is a dentist who reads scientific papers and runs experiments on himself. That's like the perfect combo.

One of the main things he does is to use a disclosing tablet on himself to show how well products get the plaque off his teeth. While I recommend you watch his videos, I'll go over some main findings here:

1. **Glide floss does a horrible job getting plaque out of between your teeth.** (I still use it to get food particles out of my teeth after eating as my teeth are very tight, and packing food between your teeth pretty much guarantees a cavity there in the future. But I am still concerned about the Teflon like material I'm being exposed to; however, until I find a natural alternative I'll still be using it.) I recreated his experiment for this and it took about 8-13 generous "brushing" the sides of my teeth with the Glide floss for there to be no disclosing dye (plaque) on the floss.
2. **Use a threaded floss to get the plaque out between your teeth.** This is because it has more of a brushing action and this is what I use at night when I go all out cleaning my teeth before going to bed. It's a pain with my tight teeth, but over time it has gotten easier to get the threaded floss between my teeth.
3. **Waterpiks/irrigators/flossers do a horrible job removing plaque between your teeth.** (Like the Glide floss, I still use it as I find, even after flossing and swishing with water, water irrigators will remove a few more food particles left behind, especially when it comes to the flaxseed in my morning breakfast.)

4. **While most are now saying not to brush within an hour after a meal as your teeth are in a weakened state and you'll further remove minerals from them, you might want to *gently* brush after a meal with a fluoride toothpaste so your teeth will remineralize with fluoride making them stronger.** This does make sense and I've been doing it, but only after breakfast. My night routine (with my more thorough/abrasive cleaning methods) is where I try to wait 2 hours after eating before brushing.
5. **Look for a toothpaste with a low Relative Dentin Abrasivity (RDA).** You can look online for charts ranking toothpastes. I think the RDA score goes from 0-250 (lower being less abrasive). Basically, it seems to really matter if your toothpaste has hydrated silica in it or not. Silica (sand) is like brushing with microscopic diamonds in a sense. He has shown how exposed roots of his patients have been worn down cause they were too thorough/abrasive when cleaning their teeth. Obviously, you also want to use a soft bristle toothbrush as well.
6. **Don't snack.** He showed that your teeth need time to get a chance to remineralize. If you're always snacking, they never get a chance to do so.
7. **Fasting can help to (possibly) permanently reduce the bacterial levels in your mouth.** Through his own experiment with disclosing tablets, he showed that fasting will reduce the plaque on your teeth as you aren't feeding them food. But he also showed that it seems to have a long-term effect even after you are done with the fast. How permanent this is, I don't know.
8. **If you're using a sonic toothbrush, you will still need to do a brushing stroke to get rid of all the plaque.** Again, he proved this with disclosing tablets. It seems like the circular motion is king, just don't do it too much as not to wear down your teeth.

Again, watch his videos as I can only cover so much here (plus, he obviously deserves views for all the hard work he has done). I will add a few more things of my own here:

1. **When it comes to disclosing tablets, I would recommend the two tone ones** (one color for old plaque and one color for new plaque) as it'll show you where you've been missing when you brush your teeth. Personally, I found I had a hairline of old plaque long almost all my teeth where they meet my gums. Also, it seems like the newer disclosing tablets barely have any ink. I found you want to take about 2-3 of those or just 1 of the old school tablets that come in those plain plastic packages. You'll spend a lot of time swishing water and spitting out ink, but you'll be guaranteed that all the plaque in your mouth will be colored.
2. **Use the bass brushing technique with a soft manual toothbrush.** Speaking of that plaque along my gumline, I came across this technique to clean there. Basically, you hold your brush at a 45 degree angle against the gumline and *gently* vibrate it along your whole gumline. I do have exposed roots (which are softer than your teeth's enamel), so I try to be nice and gentle with it. I no longer have that thin line of plaque along my gumline anymore when I use a disclosing tablet. You can google a video if you need a further explanation of the technique. I am concerned with using a sonic toothbrush along the gumline might be too abrasive to the roots.
3. **Floss and then follow up with a sonic toothbrush.** I very gently and lightly brush my teeth with a manual toothbrush first (don't want to over do it as I'll be brushing them again), including doing the bass brushing technique, then its a threaded floss, and finally a sonic toothbrush just on the enamel. Again, you need to do a brushing motion with the sonic toothbrush to get all the plaque and you'll want to use a toothpaste with a low RDA.
4. **Cleaning your tongue is pretty essential.** That's because, like a shag carpet, a lot of bacteria will be hiding there. But being too abrasive with your tongue will cause inflammation and perhaps cancer. Following a few new videos from Dr. Greger, it seems like a manual toothbrush is better than a sonic one to have less inflammation (a sign of cellular damage). I would also recommend the silicon/rubbery tongue scraper instead of the metal ones. My

favorite one currently is a plastic one with grooves. Its soft side is softer than even the silicon scrapers and it really feels like it's getting in there. If you have a white tongue, there are a lot of methods talked about online to try (salt, hydrogen peroxide, baking soda and lemon, etc.), but be careful as you don't want to damage your tongue with those harsh ingredients, which will probably happen if you're using them all the time.

That's it!

I think I'm finally done talking about teeth.

Here is to a beautiful smile. :)

EMF

This is where I sound like a crazy conspiracy theorist.

EMF stands for electromagnetic fields. It's basically three things: electrical fields (think static electricity), magnetic fields (like the fields created by magnetics, but the type created when a current goes through a wire), and electromagnetic radiation (radio waves, microwaves, etc.).

The electric fields and magnetic fields aren't too much of a concern as they are easy to measure and handle. The only exception is if you're in an old house with bad wiring, live near electric lines, or have bad wiring running under your house. In that case, it's best to call a professional.

However, the electromagnetic radiation is the real concern for most.

While, yes, for the most part electromagnetic radiation (again, I'm talking about frequencies like radio waves here) is harmless and even naturally found in nature.

However, the concern is the amount of electromagnetic radiation and the type (frequency) as each wavelength has a different effect on various molecules, including the different types of molecules found in your body. Just how water isn't normally a concern unless it is an insane amount of water or water coming at you at high speeds, it's the same situation with electromagnetic radiation.

While going into detail about how all this work and how specifically to worry about certain frequencies and other situations, the overall message is this: less is best (or at least safest).

Yes, you can get a decent EMF meter for \$100-200, but they don't measure all the signals (especially with the higher frequencies used by 5G). So it's hard to know how much radiation you're really getting hit with unless you're willing to rent a \$15,000-20,000 meter. But your EMF exposure levels could change right after returning the meter and you would never know.

With that, I want to offer three effective and practical tips when it comes to EMF.

First one: Use a EMF canopy with silver threading around your bed. They're like the bed canopies used in third world countries to keep bugs out, but you're using it to keep EMF out. They're very effective. I would add that most Faraday cages (what this essentially is) are more effective when they fully encapsulate you. Unfortunately, most of these canopies leave the ground exposed. While there is a debate if grounding your body is really all that beneficial or not, grounding a Faraday cage doesn't really seem to make a difference. While you can build your own Faraday cage around your bed using wood and copper or aluminum mesh, it's a pain to build, to sleep in, and you'll probably feel like a chicken. These EMF canopies aren't cheap (they're around \$1,000-1,500 while writing this book), but I think they're more than worth it.

Second one: Move out into the country as much as you can. I know this isn't possible for everyone, but even if you get rid of your own WiFi and don't even use cell phones, you're still being bathed in your neighbor's WiFi, TV signals, radio signals, cellular signals (even without a phone and including 5G), and whatever other signals are out there. The more you get away from the urban areas and downtowns, the better off you'll be. A simple life really is the answer to complex problems.

Third one: Keep radio wave generating devices away from your body. Don't keep your phone in your pocket all the time (it has been proven to damage sperm). Put it somewhere while at home and keep it on your car mount while driving. A little bit of distance is better than no distance at all. If your WiFi is in your office, especially on your work desk, get it as far away as possible. I think they say 6 feet is a safe distance, but that might change as our routers become more powerful and use new frequencies. Basically, distance is the best solution.

That's it. You can spend a lot of money on tinfoil hats and EMF underwear or just keep it simple and remove as much EMF from your life as possible.

The Internet

Speaking of WiFi, there is a problem with using the Internet all the time.

Not just the Internet but all screens (TVs, tablets, smartphones, computer monitors, etc.) appear to be bad for you. And I'm talking more about your mental health than anything else (so even if you aren't stationary while on it, it doesn't matter). Science shows we should probably just get rid of our televisions [318], and I'm suspecting that is probably true of all screens.

Do you really think sitting at your desk looking at a computer monitor or smartphone for 8 hours is healthy?

We're meant for human connection, to spend time with others.

Besides that is also the sugar problem.

Just how extracted white sugar is unnatural and will rot your teeth and body, extracted knowledge (especially in an entertainment format), I believe, is also unnatural and will rot your mind.

The problem is, just how we crave sugary things because of all the calories packed in it, we also crave the computer, our smartphone, and the Internet because of the "calories" of knowledge densely packed into them. But these "calories" like white sugar will probably do you more harm than good.

Most YouTube videos aren't going to change your life, despite how much as they feel like they are, and will probably just lead to addiction. We're meant for human connection.

So it's best to get knowledge from experience or from others, the more natural way. Just how it's best to get our calories from whole foods.

The Gut Microbiome

To call this a holistic guide to health (holistic means focusing on the whole organism and the interdependence of its parts, and what I changed the subtitle to), I've decided to cover this last topic. They say that there are about 10 to 1 bacteria in and on your body compared to your actual human cells, and they play a critical role in your health and survival.

Let's talk about your gut health.

Eating fruit and vegetables is a good start, plenty of fiber after all. That's all you need, right? It depends but for the most part that isn't enough.

One big lesson to understand is microbiome diversity in your gut is *critical* to good health. Having one bacterium dominating leads to all kind of system disease like irritable bowel syndrome, bile acid malabsorption, and Crohn's disease.[298][299]

Fruit and vegetables already have good bacteria on them, but if you want more you can always eat fermented foods. But you probably already know that. One study showed that fermented foods increased diversity and lowered gut inflammation.[310] However, there are other *very* important factors to consider if you want good bacteria diversity in your gut.

Ramadan style fasting has been shown to help by increasing beneficial bacteria like *Butyricicoccus*,[300] a bacteria that produces butyrate and butyrate is extremely important for gut health.[301] (Fiber also increases the amount of butyrate these microbes produce.[302]) This beneficial bacteria also helps your body to purge pathogenic bacteria.

(I know I talked poorly about fasting before, but the way I see it is like exercise. Like exercise, you can injury yourself, even permanently, if you do too much at once or improperly. Fasting can be the same. A little is good, just don't get carried away with it as many do when they start to

see the weight loss. But if you're worried about an "injury," you don't have to fast at all for better health.)

Exercise, only cardio, has been shown to help by increasing IgA (Immunoglobulin A, one of your body's antibodies) in the gut which kills the bad bacteria there and increases your gut diversity of good bacteria. [303] Keep in mind that 70-80% of the body's immune cells are found in your gut. It has also been shown to increase butyrate production as well. The study also showed that this chemical strengthens the intestinal barrier and helps to shrink tumors and possibly even kill off cancers in the gut.[303] And *vigorous* cardio exercise seems to work the best at increasing gut diversity.[304]

Getting outside has been shown to help to increase your microbiome diversity. It's all about that fresh air your parents talked about when you were young (cause the microbes that land and inhabit your skin and nose eventually work their way down to your gut).[305] So it isn't surprising that children who spent more time outdoors had more gut microbiome diversity than those who didn't.[312] (A think even a carnivore YouTuber showed that exposing her stomach to red light, which the sun has plenty of, increased her gut biodiversity despite being on a zero fiber diet.) And the air indoors tend to be less diverse and contain microbes more pathogenic in nature.[306][311] And if your house is hosting various molds, that is something you need to get checked right away. Mold (which can start growing in your gut) and their mycotoxins destroy not only the good bacteria but also the lining of your gut as well. But a healthy gut microbiome can help eliminate mycotoxins from your body.[309]

Being social also helps. Married people or those cohabiting with others have greater gut diversity compared to those who are single or isolated. [307] And, obviously, just being around other people instead of staying home all day will help to increase your gut microbiome. Besides being exposed to other people's natural bacteria they carry with them, inflammation seems to cause a decrease in gut diversity.[313] And being alone increases systemic inflammation while being with loved ones decrease it.[314] Those who frequently had sex had significantly higher IgA levels.[315] But if you don't have a partner to do that with, simply being more social will give you a better immune system (remember about

80% of which is in your gut).[316] Keep in mind that this study was done before the Internet really took off. So that means you probably need *real* face time to get the benefits. This is supported by another study showing more frequency of hugs from those who carried about you meant getting less sick.[317] So go be social if you want a healthy gut!

And good sleep is linked to microbiome diversity. That means one might cause the other, so you should work on both.[308] Besides, we all know about the ton of health benefits sleep gives you in general. So get some good sleep every night!

It really goes back to doing what we've been told all our lives: exercise, socialize, get outside, eat your vegetables, and get plenty of sleep.

The Four Pillars of Health

Let's summarize everything with the four pillars of health.

Nutrition – Eat only whole foods (vegan). And eat a variety of whole foods. Add starchy whole foods (like potatoes, beans, rice, etc.) to make sure you get all your minerals and proteins. No salt. No oil. If you do eat processed foods, try to eat low-sodium, low saturated fat, and no sugar items. Only supplement B12 and maybe vitamin D.

Sleep – Sleep until you feel rested. Try to wake up with the sun and go to sleep at the same time each day. Take a 10-15 minute nap in the middle of the day when possible.

Exercise – You need to exercise *and* be active. Try not to sit more than 3 hours a day (this includes driving and watching TV). Try to take short walking breaks at work whenever you can. Get about 30-45 minutes of vigorous exercise (you should have moments where you are gasping for air) or 1-1.5 hours of moderate exercise (you should have moments where you breathe hard) once a week. Save your workout for the weekend. Try to get out in nature when you do it to help your gut microbiome. And make it fun!

Social – Arrange your living situation where you are sharing your residency with a friend or where they live next door to you. Do more social activities with friends. Don't go to the gym alone.

Basically, it's everything you've been told growing up: eat your fruits and vegetables; avoid sugar, salt, and oil; go outside often for some fresh air and sunshine, but don't get too much sun; get plenty of sleep; exercise, but don't take it to extremes; but do stay active in life; take care of your problems (including health problems) when they're small; too much sugar will rot your teeth and too much TV will rot your brain[318] (the Internet is probably just as bad); stay busy; spend time with loved ones; and go see your dentist! Speaking of which...

Let's talk about the medical community (which would be the **fifth pillar**). I didn't talk about it before because it really comes down to you using your head. Why? Well, doctors are one of the leading causes of death. So people are often quick to say that they shouldn't be trusted. But Steve Jobs would probably still be here if he had taken his doctor's advice (his type of pancreatic cancer was easily treatable in the early stages, but he decided on a more natural path). But, then again, I had a grandma who died because she would take any medicine a doctor would prescribe and it caused her liver to fail. But there are certainly people who have also died because of herbal supplements they were taking. Then there are the dentists we talked about. If you don't get your teeth checked regularly, one hole in your tooth could literally kill you. But most dentist will push for unhealthy practices like root canals, which can give you health problems later down the road. And, also, too many X-rays to your head aren't good for you either.

All I can say is to use your critical thinking skills when it comes to any type of treatment. That means not dismissing the medical community altogether (especially when these people dedicate their *entire lives* and schooling to learning about *your* problem). I made that mistake and wouldn't want you to do the same. But also do your *own* research and make your *own* decisions. And be willing to also seek out a second opinion when making important health decisions. And don't always submit to any procedure they suggest without looking into it yourself, including any kind of scans.

Finally, don't take things to extremes, including your health. Having a slice of cake on your birthday won't be the end of the world (you might even like it). What's the point of being in better health if you don't enjoy it every now and then? None of us are going to live forever.

Good luck on your journey towards a better life!

Surprise! Meat is Good for You!

(What?!?)

Just when I thought I was finished with this book...

I'm not going to cite studies as the study of the carnivore diet is new, but I think there are some solid scientific facts that explains what is going on.

Years ago, I heard about the carnivore diet through Jordan Peterson and other guests on the Joe Rogan's Podcast. Having already written and rewritten this book, I just wrote them off as crazy. But there might be something to it as personal stories keep showing up online about the benefits. Plus, I keep seeing this trend of personal and anecdotal evidence later being proven and explained by scientific studies, so ignoring these stories (especially considering the title of this book) would be foolish of me. So let's take a closer look at this carnivore diet.

They claim the following benefits:

- Better skin (especially in treating skin conditions like eczema, psoriasis, and vitiligo)
- Healing joints (especially when it comes to chronic arthritis)
- Cures depression
- Less brain fog
- Less bloating
- Surprisingly, that it is good for your kidneys (as high blood sugar damages your kidneys)
- Better teeth health (cause it's zero sugar and high in certain vitamins that are good for teeth)

- Better gum health (receding gums are often caused by bacteria, probably the ones also feeding off of sugar)
- Weight loss (satiates you and makes you not want to snack all the time)

Those are the most well-known benefits. But what could explain this after all the facts in this book? Basically, it's a **no sugar diet**. This removes all the glucose from your body and makes you rely on ketones.

You have to understand that bacteria is EVERYWHERE, even in your joints (it often explains chronic arthritis). By stripping sugar from your body, you are starving the bacteria in your body.

Yes, while fruits and vegetables have sugar alcohol (xylitol, erythritol, allulose, etc.) and plant chemicals to kill these bacteria, at the end of the day it is mostly fructose, glucose and sucrose (fructose and glucose combined) that makes up carbohydrates. Even starch is just a chain of sugar molecules.

Just how the *S. mutans* in your mouth would have to eventually die off if you ate no sugar, it's the same with any bacteria living off your glucose in your body, including your joints. Even about 80% of eczema originates from bacteria attacking your skin and they probably need or are accelerated by the glucose that comes from your sweat and sebum.

Finally, there is the argument about detoxing plant toxins that are made to kill the bugs that eat these plants. However, there is also the argument that these toxins stress our bodies in a good way like exercise and/or that these plant toxins only go after our cancer cells or don't bother us at all. There doesn't seem to be solid evidence of plant toxins being a problem at the moment, but we do know a plant-based diet is the best for longevity. So whatever the case might be, it probably isn't something to worry about. There is a reason we only eat certain plants.

But if this is true, wouldn't we see the same results with fasting?

You're right, and we do. Water fasting tends to give the same benefits.

As I've warned before, doing it for too long can have detrimental health effects as reported by many who do 30 day or more of water fasting. I would suggest no more than two weeks.

But with a carnivore diet, however, you could probably go months-sugar free on it and still be able to reverse the atherosclerotic plaque it gives by later using a vegan diet. (Plus, people report low inflammation levels while on it, so it might help not even result in much plaque build up.)

But are there benefits exclusive to the carnivore diet?

Yes, there are probably benefits exclusively to that diet. To understand this conclusion, we have to look at what is in meat:

- Vitamin A (especially with liver)
- Hyaluronic acid (hydrates your skin and joints)
- Gelatin/collagen

These three ingredients help to explain the skin benefits. The hyaluronic acid and collagen could also explain the joint benefits. The only thing it is really low on is vitamin C, but they claim that glucose and vitamin C compete with each other. So, since your diet is low in glucose, they claim you become more vitamin C sensitive. This is probably true since cancer can often be treated by high levels of vitamin C. This works because cancer cells are often glucose greedy, but can't process vitamin C. Just how xylitol kill *S. mutans*, your cancer cells greedily takes all the vitamin C in your body (thinking it's glucose) and dies. So less glucose in the body probably means more vitamin C uptake by your cells in general.

It could be good for cancer?

Yes, that brings me to another benefit, it might help to fight cancer since it would be starved of glucose. Don't believe me? The PET scan often used to detect cancer in the body is done by first having the patient "fast" for two days before (this "fast" is actually a meat-based/zero carbohydrate diet). Then radioactive glucose is injected into your body because it goes to your cancer cells first. So starving cancer cells of sugar could kill it or at least slow it down.

What about the gut?

This diet would also help with SIBO (small intestine bacterial overgrowth) or SIFO (small intestine fungal overgrowth). Your small intestine isn't really supposed to have bacteria in it. It does this by constantly pushing stuff down it. When bacteria grows from the large intestine to the small intestine, it can block bile absorption (95% is absorbed at the tail end of your small intestine) and causes problems in your large intestine. Starving the bacteria and fungus is one way to get rid of this overgrowth. In fact, one of the treatment plans for SIBO is the FODMAP diet. FODMAP stands for fermentable carbohydrates (these various carbohydrate names form the ODMAP part of the word). The diet is basically only meat and a few select vegetables.

Don't get me wrong, fiber is king when it comes to gut health, but certain situations might call for you to take a break from fiber.

Any real negatives to this diet?

My main concern is iron. Remember, it is an essential nutrient but also does oxidative stress to your body. The iron found in meat can't be kept out and your body has no way of getting rid of it. So I would give blood when you can to get rid of excess iron.

You will also experience low testosterone if you're a guy on this diet. The carnivore community argues that they become more testosterone sensitive. They argue this because their athletic performance gets better and they notice no drop in their sex drive. This might be true. But there is probably an initial adjustment phase. Testosterone doesn't just build muscle and give you energy, it also protects your joints. So I wouldn't be doing anything intense or heavy when you first start out.

In that same regard, your body needs vitamin C to make collagen (I *believe* that animal collagen you consume is first broken down into its amino acids and then turned into collagen using vitamin C and zinc). Even though your body will also probably become more vitamin C sensitive, you should give your body time to adjust. Also, make sure to include liver in your diet as it has vitamin C. This follows the carnivore diet's advice of eating nose-to-tail of an animal like your ancestors did.

And I would add a *little* bit of a salt heavy in other minerals (like Celtic salt or pink salt) as meat is low in sodium and you are restricting your diet to one source of food. Remember, just a sprinkle.

Finally, don't eat processed meats. That means no hot dogs, sausages, or deli meats (they often have sugar added to them).

Hey, what about all that inflammation from eating meat?

That's the surprising thing, these carnivores have low marks of inflammation. While inflammation typically comes after you eat meat because the body detects the dead bacteria in it and gives an inflammatory response, these meat eaters tend to naturally eat less meals. So their bodies aren't always bathed in inflammation. Plus, you aren't feeding any current bacterial infection in your body with glucose.

This is bizarre, should I really do this diet?

No, you don't have to. The vegan diet is still king when it comes to longevity and overall health. Plus, and this is an argument given by the carnivore community itself, the closer your ancestors were to the equator, the better off you probably are with less meat as your ancestors always had plants around to eat.

Think about it, in a population living where you have a winter that kills off all vegetation, probably the *only* thing you have to eat is a ruminant animal (cow, buffalo, bison, etc.) that you caught. The meat would also stay fresher longer because of the cold weather.

So you would basically only be eating meat or starving/fasting.

This also might explain seasonal affective disorder (SAD) that is experienced by some during the winter. The treatment for SAD is often light therapy using strong full spectrum light that mimics sunlight. But this doesn't make sense. The light their ancestors experienced during winter is very low (that's why it gets cold). They couldn't make their own light (fire isn't good enough, not enough photons and not full spectrum), thus there had to be a different mechanism they used to treat depression.

I think we found it as fasting and the carnivore diet appears to treat depression. Exposing yourself to the cold might also help with depression. So you can do those cold showers or ice baths that are popular during the Internet during your carnivore diet. (Another explanation/treatment for depression is socializing. You would be stuck in a cave with your loved ones all winter long.)

Seriously, are you really suggesting this kind of diet at the end of this book?!?

Again, you don't have to do this diet at all. The vegan diet is still the best. And I'm definitely not suggesting you do the carnivore diet for life, even though there are people who have done it for up to 10 years. Let those people find out if they've done permanent damage to their health or not. But if you want to try it or think it'll help you with your specific health problems, this is the advice I would give:

- Do this diet in the winter. That's how your ancestors probably did it and I don't think it is a coincidence that World Carnivore Month is in January, often the cold month of the year if you live in Europe or America.
- Include fasting in this diet. Many do OMAD (one meal a day) or 2MAD. This is often very easy as meat is extremely satiating. But I would include full day fasting as well. More on this later.
- Do it for 1 to 3 months. For your first year, I would only do it for one week. The carnivore diet can be very expensive. This way you can see if it works for you.
- I would also do a 1-week fast *before* you get on your meat-based diet. This way your body is already running on ketones and has leaned to be more resourceful.
- Add Celtic salt to your meat.
- Eat gelatin/jello (if you aren't eating/boiling animal joints and cartilage)

- Include liver (for vitamin C) and canned sardines (has a ton of EPA which has been shown to treat depression and tends to be lower in mercury than other fish).
- When you're done with this diet, go give blood to get rid of excess iron, especially if you're male (your ancestors probably bleed when hunting animals for meat).
- If you're physically active enough to break a sweat (as the carnivore community loves to work out), add salt. Remember, clean meat is low in sodium.
- Finally, read a little from the carnivore community before starting this diet as they know more than I do on this diet.

So you want me to fast for a week before starting? I've never fasted that long before. How should I do it?

A 7-day water fast is based off the recommendation of Doctor Pradip Jamnadas. But even he recommends to ease into it by trying shorter fasts.

For the longest time, I had a hard time doing fasts. I would do an intermittent fast until 2 PM, 4 PM, or 6 PM, only to stop doing it after a day or two. However, I've been very successful lately because of a new strategy. I didn't eat until noon (12 PM) and I also didn't eat after 8 PM. I was able to go weeks and months like that. This is a lot easier because you basically skip breakfast, which I'm sure you've done before by mistake. After doing that for a week or two, I found myself pushing it to 1 PM and 2 PM with ease. Eventually, I got down to 4 and 6 PM. Your body really does adapt to the stressors you put on it. But I stopped because fasting, like the carnivore diet, lows your testosterone and I had heavy lifting to do. I'm not sure if fasting also makes you testosterone sensitive like the carnivore diet as suggested by advocates of it. But I certainly didn't know about testosterone sensitivity back and decided to stop. After that, fasting for several days in a row was easy. I was able to do 3 days of a water fast and later 2 days of a dry fast (no food or water). I could have gone longer but had to do manual labor work.

Dr. Pradip Jamnadas recommends a 7-day water fast either once or twice a year to get the maximum benefits of fasting. I think right after the holidays is a good time to do it. Come around October, I suggest you do intermittent fasting till 12 PM for two weeks on the weekdays to get your body used to it. Try to push yourself to later times of the day. Try to be fasting until at least 4 PM by the end of those two weeks. Then take two weeks off. Then fast for two Saturdays in a row. Then take another two weeks off. Then fast for an entire weekend (two days in a row). Then take three weeks off. Then you can do your 7-day water fast. If you want to, you could do 5 days of a water fast and end it with 2 days of dry fasting.

(Dry fasting is a new community. While I've seen a few accounts saying that dry fasting at the end of a water fast is the best, many also say that is dangerous would suggest doing a dry fast only before a water fast. Unfortunately, we probably won't have any studies on this issue for a long time.)

Dry fasting stresses your body in a different way than water fasting, so it has its own benefits. And your body can make its own water. Your fat molecules break down into H₂O and carbon dioxide. People seem to feel better and get better results by dry fasting after a water fast and not the other way around.

(As always, consult your doctor before you do any kind of fasting.)

Then you should break your fast with water (if you were dry fasting) and bone broth a few hours later. A few hours after that, try eating a small amount of meat like 4 ounces. I would wait a day until you eat more meat (don't eat anything close to bedtime as laying down after your first meal might give you stomach aches and/or acid reflux). Then you can go on to your meat-based diet for the week.

I would try it for a week or two to see how you feel. Then next year you can go 1 to 3 months. But I would still switch back to strictly plant foods after that. If you're a guy, since you are now more testosterone sensitive, you might see a big boost in your mood from all the carbs you eat later on in a vegan diet as they will increase your testosterone. This might explain why Spring is often seen as the season of love...

Plus, a plant-based diet will hopefully undo any damage you've done to your body from the meat. But try to also give blood after you're done with your carnivore ways for the year.

(After writing this book, I found out that scientists will give animals coconut oil (saturated fat) to clog their arteries, but they'll also add sugar to accelerate the process. I remember a vegan years ago saying to stay away from fat if you're eating sugar. It seems like he was right. So go low-fat, whole-food vegan or high-fat, no-sugar carnivore for better health. Ideally, I still think you should only do carnivore for a short period of time.)

(I just wanted to add that I will not be updating this part of the book. This is/was a vegan book and that's why I did so many updates when I learned new things. There are plenty of carnivore people online if you want to learn more about this diet. And despite all the updates to this book, the basics pretty much remained the same. That's why the guides haven't really changed since I first created this book.)

Finally, I know it's odd that I ended the book with this chapter, but don't take health so seriously. As pointed out by YouTuber Plant Chompers, while comparing health authors and how long they lived, there were examples of people eating animal products living past 100. However, they still ate mostly fruits and vegetables and avoided things like trans fat, sugar, and processed foods.

Just how millionaires are some of the most miserable people I know, those who don't save and aren't smart with their money tend to be miserable as well. Don't make yourself miserable trying to eat the perfect diet, but you would be a fool to eat junk food all the time. Look, you can overanalyze things forever and still get it wrong. There are just too many factors to consider in life. Just look how much work I did to get the perfect remineralization and anti-*S. mutans* program only to fail. But, thankfully, dentists exist. Just how there is paralysis by analysis, there is also failure by trying too many things or by trying to be perfect. There is also putting your life on hold because you are trying too many things or trying to be perfect. None of us are going to be here forever, so it's much more important to enjoy life while you can. The point is you should make a conscious effort to be healthier without making yourself miserable. And

knowledge is power, so hopefully you know the right direction to take your life after reading this book.

Finally, I wanted to say that knowledge can only bring you so far. Life, even in regards to your health, is often about experimenting to see what works for you. It is also about humbling yourself to ask an expert for their advice as well. The people who spend their entire lives learning about this one aspect of your health probably knows more than you and me. Not to say there aren't people out there trying to take advantage of you or who are stuck in their ways, but that's what second opinions are for. You've learned a lot from this book, but I hope you don't let it stop there.

Guides

Always consult your doctor before you change what you eat.

Here is an easy food guide, shopping guide, to-do list, and supplement guide to use for your first week. I'm sure you'll figure out everything else from there.

Food Guide

Just remember to eat your oats, greens, and beans every day. Feel free to add other plant foods to boost their nutritional value but avoid adding salt.

Breakfast

- ☐ Oatmeal with berries and flaxseeds

Lunch

- ☐ Mixed greens with nuts

Dinner

- ☐ Beans and rice or potatoes

Snacks

- ☐ Mixed frozen vegetables
- ☐ Air-popped popcorn
- ☐ Various fruits

Drinks

- ☐ Tap water (add some lemon juice and drink through a straw, but first always filter it with a charcoal filter)
- ☐ Coffee (avoid if pregnant, breastfeeding, or a child, no more than 4 cups a day)
- ☐ Soymilk or other plant milks
- ☐ Green tea, peppermint tea, and hibiscus tea
- ☐ Hot chocolate (no sugar)

Shopping Guide

Breakfast

- ☐ Oatmeal
- ☐ Mixed frozen berries
- ☐ Flaxseed

Lunch

- ☐ Mixed leafy greens
- ☐ Organic carrots
- ☐ Celery
- ☐ Beets
- ☐ Walnuts
- ☐ Almonds
- ☐ Sunflower seeds (no salt)
- ☐ Cranberries
- ☐ Raisins

Dinner

- ☐ Brown rice, dry
- ☐ Brown rice, microwavable
- ☐ Beans, dry (various)
- ☐ Beans, canned (various, low-sodium)
- ☐ Condiments - like salsa, hot sauce, ketchup, pepper, herb mix (low/no-sodium)
- ☐ Potatoes
- ☐ Sweet Potatoes

Snacks and Misc.

- ☐ Lemons and straws
- ☐ Popcorn for air popping
- ☐ Frozen vegetables (various)
- ☐ Fresh fruit
- ☐ B12 supplement
- ☐ Vitamin D
- ☐ Coffee grounds
- ☐ Paper coffee filters
- ☐ Iodized salt

To-Do List

- ☐ Take B12 (and possibly vitamin D) daily
- ☐ Squeeze lemon wedges into drinking water
- ☐ Sign up for and use Cron-o-Meter for a week
- ☐ Get your cholesterol levels tested
- ☐ Look up tasty vegan recipes online
- ☐ No cooking oils or dressings
- ☐ Donate blood twice a year
- ☐ Swish and spit with filtered tap water (no lemon) after meals to get food particles out of your mouth (use a flosser or toothpick for stubborn particles)
- ☐ See a dentist twice or at least once a year (make sure they use only digital X-ray cameras)
- ☐ Don't snack all the time (give your teeth a break to remineralize)
- ☐ Don't live in moldy homes
- ☐ Take frequent walking breaks during work
- ☐ Stay under 1,000 mg of sodium (unless you sweat a lot)
- ☐ Be more active and have more physical fun on the weekends (get more fresh air and sunshine with your friends)

Supplement Guide

- ☐ Pregnant and breastfeeding women - Prenatal vitamin (read the label for 150 mcg of iodine) or one serving (10 grams) of roasted seaweed (nori)
- ☐ Athletes in the hot sun - DIY sports drink (only drink *after* sweating):
 - ¼ teaspoon of iodized salt
 - ¾ teaspoon of kosher or sea salt
 - 8 sugar cubes (8 teaspoons) or xylitol, erythritol, or monk fruit if you're worried about cavities
 - 32 ounces (4 cups) of water
 - Splash or up to ½ cup of coconut water
 - Squeezed lemons and limes or hibiscus petals
- ☐ People who work out but don't sweat a lot - no need for a salty sports drink. Just eat a variety of fruits and vegetables.
- ☐ B12
- ☐ Vitamin D
- ☐ *Optional* - Vegan protein shake
- ☐ *Optional* - Algae-based omega-3

Further Reading

Guess what? There are even more reasons to avoid animal products!

Nutritionfacts.org - If you enjoy finding out interesting health facts, this should be your number one site. Dr. Greger does an awesome job of researching the newest studies and linking it all together.

DrEsselstyn.com - All these years and Dr. Esselstyn is still at it. See what he has been up to on his website. You might be able to catch him at one of his speaking events.

VeganHealth.org - Looking for more information on eating a proper vegan diet? This site is a great resource. The site is maintained by Jack Norris RD.

PlantPositive.com - If you really want to see some deep analysis of studies, check out Plant Positive. The author of this site has decided to stay anonymous.

Acknowledgments

The beautiful background photographs used for the book cover were designed by Valeria_aksakova - [Freepik.com](https://www.freepik.com)

The vast majority of the studies and arguments used in the first half of this book and a good number of studies in the second half were originally found/brought to the public's attention by Dr. Greger - [NutritionFacts.org](https://nutritionfacts.org)

Finally, thank you for reading this book. Please consider giving it or copies of it to the people you care about. It might just save their lives.

References

- [1] Lansley KE, Winyard PG, Bailey SJ, Vanhatalo A, Wilkerson DP, Blackwell JR, Gilchrist M, Benjamin N, Jones AM. Acute dietary nitrate supplementation improves cycling time trial performance. *Med Sci Sports Exerc.* 2011 Jun;43(6):1125-31
- [2] Larsen FJ, Schiffer TA, Borniquel S, Sahlin K, Ekblom B, Lundberg JO, Weitzberg E. Dietary inorganic nitrate improves mitochondrial efficiency in humans. *Cell Metab.* 2011 Feb 2;13(2):149-59.
- [3] Pan A, Sun Q, Bernstein AM, Schulze MB, Manson JE, Stampfer MJ, Willett WC, Hu FB. Red Meat Consumption and Mortality: Results From 2 Prospective Cohort Studies. *Arch Intern Med.* 2012;0(2012):201122871-9.
- [4] Rohrmann S, Overvad K, Bueno-de-Mesquita HB, Jakobsen MU, Egeberg R, Tjønneland A, Nailler L, Boutron-Ruault MC, Clavel-Chapelon F, Krogh V, Palli D, Panico S, Tumino R, Ricceri F, Bergmann MM, Boeing H, Li K, Kaaks R, Khaw KT, Wareham NJ, Crowe FL, Key TJ, Naska A, Trichopoulou A, Trichopoulos D, Leenders M, Peeters PH, Engeset D, Parr CL, Skeie G, Jakszyn P, Sánchez MJ, Huerta JM, Redondo ML, Barricarte A, Amiano P, Drake I, Sonestedt E, Hallmans G, Johansson I, Fedirko V, Romieux I, Ferrari P, Norat T, Vergnaud AC, Riboli E, Linseisen J. Meat consumption and mortality - results from the European Prospective Investigation into Cancer and Nutrition. *BMC Med.* 2013 Mar 7;11:63. doi: 10.1186/1741-7015-11-63.
- [5] Sinha R, Cross AJ, Graubard BI, Leitzmann MF, Schatzkin A. Meat intake and mortality: a prospective study of over half a million people. *Arch Intern Med.* 2009 Mar 23;169(6):562-71. doi: 10.1001/archinternmed.2009.6.
- [6] Renata Micha, RD, PhD, Sarah K. Wallace, BA, and Dariush Mozaffarian, MD, DrPH. Red and processed meat consumption and risk of incident coronary heart disease, stroke, and diabetes mellitus: a systematic review and meta-analysis. *Circulation.* 2010 Jun 1;121(21):2271-83. doi: 10.1161/CIRCULATIONAHA.109.924977. Epub 2010 May 17.

- [7] Rose G (Department of Epidemiology, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK). Sick individuals and sick populations. *International Journal of Epidemiology*. 1985;14:32-38.
- [8] Kwok T, Chook P, Qiao M, Tam L, Poon YK, Ahuja AT, Woo J, Celermajor DS, Woo KS. Vitamin B-12 supplementation improves arterial function in vegetarians with subnormal vitamin B-12 status. *J Nutr Health Aging*. 2012;16(6):569-73.
- [9] Steele TM, Frazer DM, Anderson GJ. Systemic regulation of intestinal iron absorption. *IUBMB Life*. 2005 Jul;57(7):499-503.
- [10] West AR, Oates PS. Mechanisms of heme iron absorption: Current questions and controversies. *World Journal of Gastroenterology: WJG*. 2008;14(26):4101-4110. doi:10.3748/wjg.14.4101.
- [11] Leo R Zacharski, Bruce K Chow, Paula S Howes, Galina Shamayeva, John A Baron, Ronald L Dalman, David J Malenka, C Keith Ozaki, Philip W Lavori. Decreased Cancer Risk After Iron Reduction in Patients With Peripheral Arterial Disease: Results From a Randomized Trial. *JNCI: Journal of the National Cancer Institute*. July 2008;100(14):996–1002 doi:10.1093/jnci/djn209.
- [12] Alexander DD, Crushing CA. Red meat and colorectal cancer: a critical summary of prospective epidemiologic studies. *Obes Rev*. 2011 May;12(5):e472-93. doi: 10.1111/j.1467-789X.2010.00785.x.
- [13] Denis E Corpet. Red meat and colon cancer: Should we become vegetarians, or can we make meat safer? *Meat Sci*. 2011;89(3):310-6.
- [14] *Ibidem*.
- [15] George v Mann, Anne Spoerry, Margarete Gary and Debra Jarashow. Atherosclerosis in the Masai. *American Journal of Epidemiology* Volume 95, Issue 1 P. 26-37.
- [16] Fontana L, Meyer TE, Klein S, Holloszy JO. Long-term low-calorie low-protein vegan diet and endurance exercise are associated with low cardiometabolic risk. *Rejuvenation Res*. 2007 Jun;10(2):225-34.
- [17] Thompson RC, Allam AH, Lombardi GP, Wann LS, Sutherland ML, Sutherland JD, Soliman MA, Frohlich B, Mininberg DT, Monge JM, Vallodolid CM, Cox SL, Abd el-Maksoud G, Badr I, Miyamoto MI, el-Halim, Thomas GS. Atherosclerosis across 4000 years of human history: the Horus study of four ancient populations. *Lancet*. 2013 Apr

- 6;381(9873):1211-22. doi: 10.1016/S0140-6736(13)60598-X. Epub 2013 Mar 12.
- [18] J Higginson, W J Pepler. *Fat Intake, Serum Cholesterol Concentration, and Atherosclerosis in the South African Bantu Part II Atherosclerosis and Coronary Artery Disease. J Clin Invest.* 1954;33(10):1358–1365.
- [19] DP Burkitt. *The etiological significance of related diseases. Can Fam Physician.* 1976;22:63-71.
- [20] Campbell TC, Parpia B, Chen J. *Diet, lifestyle, and the etiology of coronary artery disease: the Cornell China study. Am J Cardiol.* 1998 Nov 26;82(10B):18T-21T.
- [21] *Global status report on noncommunicable diseases 2010.* Geneva, World Health Organization, 2011.
- [22] Mensink RP, Katan MB. *Effect of dietary fatty acids on serum lipids and lipoproteins. A meta-analysis of 27 trials. Arterioscler Thromb.* 1992 Aug;12(8):911-9.
- [23] Vered Padler-Karavani, Hai Yu, Hongzhi Cao, Harshal Chokhawala, Felix Karp, Nissi Varki, Xi Chen, and Ajit Varki. *Diversity in specificity, abundance, and composition of anti-Neu5Gc antibodies in normal humans: potential implications for disease. Glycobiology.* 2008 Oct;18(10):818-30.
- [24] Varki A. *Colloquium paper: uniquely human evolution of sialic acid genetics and biology. Proc Natl Acad Sci U S A.* 2010 May 11;107 Suppl 2:8939-46.
- [25] Erridge C. *The capacity of foodstuffs to induce innate immune activation of human monocytes in vitro is dependent on food content of stimulants of Toll-like receptors 2 and 4. Br J Nutr.* 2011 Jan; 105(1):15-23.
- [26] Egger G, Dixon J. *Non-nutrient causes of low-grade, systemic inflammation: support for a 'canary in the mineshaft' view of obesity in chronic disease. Obes Rev.* 2011 May;12(5):339-45.
- [27] Arya F, Egger S, Colquhoun D, Sullivan D, Pal S, Egger G. *Differences in postprandial inflammatory responses to a 'modern' v. traditional meat meal: a preliminary study. Br J Nutr.* 2010 Sep;104(5):724-8.
- [28] Jaime Uribarri, MD; Sandra Woodruff, RD; Susan Goodman, RD; Weijing Cai, MD; Xue Chen, MD; Renata Pyzik, MA, MS; Angie Yong,

- MPH; Gary E. Striker, MD; Helen Vlassara, MD. Advanced glycation end products in foods and a practical guide to their reduction in the diet. *J Am Diet Assoc.* 2010 Jun;110(6):911-16.e12.
- [29] Zaidi R, Kumar S, Rawat PR. Rapid detection and quantification of dietary mutagens in food using mass spectrometry and ultra performance liquid chromatography. *Food Chem.* 2012 Dec 15;135(4):2897-903. doi: 10.1016/j.foodchem.2012.07.065. Epub 2012 July 20.
- [30] Lucenteforte E, Talamini R, Bosetti C, Polesel J, Franceschi S, Serraino D, Negri E, La Vecchia C. Macronutrients, fatty acids, cholesterol and pancreatic cancer. *Eur J Cancer.* 2010 Feb;46(3):581-7.
- [31] Chan JM, Wang F, Holly EA. Sweets, sweetened beverages, and risk of pancreatic cancer in a large population-based case-control study. *Cancer Causes Control.* 2009 Aug;20(6):835-46.
- [32] Self Nutrition Data: Foods highest in Methionine (based on levels per 200-Calorie serving). <http://nutritiondata.self.com/foods-000084000000000000000000.html>
- [33] Nachman KE, Baron PA, Raber G, Francesconi KA, Navas-Acien A, Love DC. Roxarsone, inorganic arsenic, and other arsenic species in chicken: A U.S.-Based market basket sample. *Environ Health Perspect.* 2013;121(7):818–824.
- [34] Rohrmann S, Linseisen J, Jakobsen MU, Overvad K, Raaschou-Nielsen O, Tjønneland A, Boutron-Ruault MC, Kaaks R, Becker N, Bergmann M, Boeing H, Khaw KT, Wareham NJ, Key TJ, Travis R, Benetou V, Naska A, Trichopoulou A, Pala V, Tumino R, Masala G, Mattiello A, Brustad M, Lund E, Skeie G, Bueno-de-Mesquita HB, Peeters PH, Vermeulen RC, Jakszyn P, Dorronsoro M, Barricarte A, Tormo MJ, Molina E, Argüelles M, Melin B, Ericson U, Manjer J, Rinaldi S, Slimani N, Boffetta P, Vergnaud AC, Khan A, Norat T, Vineis P. Consumption of meat and dairy and lymphoma risk in the European Prospective Investigation into Cancer and Nutrition. *Int J Cancer.* 2011 Feb 1;128(3):623-34.
- [35] Johnson ES, Ndetan H, Lo KM. Cancer mortality in poultry slaughtering/processing plant workers belonging to a union pension fund. *Environ Res.* 2010 Aug;110(6):588-94.
- [36] Swan SH. Environmental phthalate exposure in relation to reproductive outcomes and other health endpoints in humans. *Environ Res.* 2008 Oct;108(2):177-84.

- [37] Colacino JA, Harris TR, Schechter A. Dietary intake is associated with phthalate body burden in a nationally representative sample. *Environ Health Perspect.* 2010 Jul;118(7):998-1003. Epub 2010 Apr 14.
- [38] Johnson ES, Yau LC, Zhou Y, Singh KP, Ndetan H. Mortality in the Baltimore union poultry cohort: non-malignant diseases. *Int Arch Occup Environ Health.* 2010 Jun;83(5):543-52.
- [39] Andrew E Waters, Tania Contente-Cuomo, Jordan Buchhagen, Cindy M Liu, Jeffrey T Foster, Jolene Bowers, Elizabeth M Driebe, David M Engelthaler, Paul S Keim, and Lance B Price. Multidrug-Resistant *Staphylococcus aureus* in US Meat and Poultry. *Clin Infect Dis.* 2011 May;52(10):1227-30.
- [40] Philippe Grandjean, Esben Budtz-Jørgensen, Dana B. Barr, Larry L. Needham, Pal Weihe, and Birger Heinzow. Elimination half-lives of polychlorinated biphenyl congeners in children. *Environ. Sci. Technol.* 2008;42(18):6991–6996.
- [41] Rantakokko P, Kuningas T, Saastamoinen K, Vartiainen T. Dietary intake of organotin compounds in Finland: a market-basket study. *Food Addit Contam.* 2006 Aug;23(8):749-56.
- [42] Grün F, Blumberg B. Environmental obesogens: organotins and endocrine disruption via nuclear receptor signaling. *Endocrinology.* 2006 Jun;147(6 Suppl):S50-5. Epub 2006 May 11.
- [43] White RF, Palumbo CL, Yurgelun-Todd DA, Heaton KJ, Weihe P, Debes F, Grandjean P. Functional MRI approach to developmental methylmercury and polychlorinated biphenyl neurotoxicity. *Neurotoxicology* 2011 32(6):975–980.
- [44] Zeilmaker MJ, Hoekstra J, van Eijkeren JC, de Jong N, Hart A, Kennedy M, Owen H, Gunnlaugsdottir H. Fish consumption during child bearing age: a quantitative risk-benefit analysis on neurodevelopment. *Food Chem Toxicol.* 2013;54:30-34.
- [45] Dariush Mozaffarian, MD, DrPH; Eric B Rimm, ScD. Fish Intake, Contaminants, and Human Health: Evaluating the Risks and the Benefits. *JAMA.* 2006;296(15):1885-1899. doi:10.1001/jama.296.15.1885.
- [46] Chiu AS, Gehring MM, Welch JH, Neilan BA. Does α -Amino- β -methylaminopropionic Acid (BMAA) Play a Role in Neurodegeneration? *International Journal of Environmental Research and Public Health.* 2011;8(9):3728-3746. doi:10.3390/ijerph8093728.

- [47] Al-Sammak MA, Hoagland KD, Cassada D, Snow DD. Co-occurrence of the Cyanotoxins BMAA, DABA and Anatoxin-a in Nebraska Reservoirs, Fish, and Aquatic Plants. *Toxins*. 2014;6(2):488-508. doi:10.3390/toxins6020488.
- [48] R M Weggemans, P L Zock, M B Katan. Dietary cholesterol from eggs increases the ratio of total cholesterol to high-density lipoprotein cholesterol in humans: a meta-analysis. *Am J Clin Nutr*. 2001 May;73(5):885-91.
- [49] S Mora, J D Otvos, N Rifai, R S Rosenson, J E Buring, P M Ridker. Lipoprotein particle profiles by nuclear magnetic resonance compared with standard lipids and apolipoproteins in predicting incident cardiovascular disease in women. *Circulation*. 2009 Feb 24;119(7):931-9.
- [50] Fernandez ML. Dietary cholesterol provided by eggs and plasma lipoproteins in healthy populations. *Curr Opin Clin Nutr Metab Care*. 2006 Jan;9(1):8-12.
- [51] C Dubois, M Armand, N Mekki, H Portugal, A M Pauli, P M Bernard, H Lafont, D Lairon. Effects of increasing amounts of dietary cholesterol on postprandial lipemia and lipoproteins in human subjects. *J. Lipid Res*. 1994;35(11):1993–2007.
- [52] D B Zilversmit. Atherogenesis: A postprandial phenomenon. *Circulation* 1979;60(3):473–485.
- [53] Spence JD, Jenkins DJ, Davignon J. Dietary cholesterol and egg yolks: not for patients at risk of vascular disease. *Can J Cardiol*. 2010 Nov;26(9):e336-9.
- [54] Hu FB, Stampfer MJ, Rimm EB, et al. A prospective study of egg consumption and risk of cardiovascular disease in men and women. *JAMA*. 1999; 281:1387-94.
- [55] Michael J Thun, Brian D Carter, Diane Feskanich, Neal D Freedman, Ross Prentice, Alan D Lopez, Patricia Hartge, Susan M Gapstur. 50-Year Trends in Smoking-Related Mortality in the United States. *New England Journal of Medicine*. 2013;368(4):351. DOI: 10.1056/NEJMsa1211127.
- [56] American Optometric Association. Lutein & Zeaxanthin. <http://www.aoa.org/patients-and-public/caring-for-your-vision/lutein?sso=y>
- [57] Z Wang, E Klipfell, B J Bennett, R Koeth, B S Levison, B Dugar, A E Feldstung, E B Britt, X Fu, Y-M Chung, Y Wu, P Schauer, J D Smith, H Allayee, W H W Tang, J A DiDonato, A J Lusis, S L Hazen. Gut flora

metabolism of phosphatidylcholine promotes cardiovascular disease. Nature. 2011;472(7341):57-63.

[58] Aune D, De Stefani E, Ronco AL, Boffetta P, Deneo-Pellegrini H, Acosta G, Mendilaharsu M. Egg consumption and the risk of cancer: a multisite case-control study in Uruguay. *Asia Pac J Cancer Prev. 2009;10(5):869-76.*

[59] E L Richman, S A Kenfield, M J Stampfer, E L Giovannucci, S H Zeisel, W C Willett, J M Chan. Choline intake and risk of lethal prostate cancer: incidence and survival. *Am J Clin Nutr. 2012 Oct;96(4):855-63. Epub 2012 Sep 5.*

[60] European Food Safety Authority (EFSA). Results of the monitoring of non dioxin-like PCBs in food and feed. *EFSA Journal 2010; 8(7):1701. [35 pp.]. doi:10.2903/j.efsa.2010.1701.*

[61] Thuy D Pham, J L Spencer, Vicki L Traina-Dorge, David A Mullin, Robert F Garry & Eric S Johnson. Detection of exogenous and endogenous avian leukosis virus in commercial chicken eggs using reverse transcription and polymerase chain reaction assay. *Avian Pathology. (1999) 28, 385±392.*

[62] Johnson ES, Ndetan H, Lo KM. Cancer mortality in poultry slaughtering/processing plant workers belonging to a union pension fund. *2010 Aug;110(6):588-94. doi: 10.1016/j.envres.2010.05.010. Epub 2010 Jun 11.*

[63] Qin LQ, Xu JY, Wang PY, Kaneko T, Hoshi K, Sato A. Milk consumption is a risk factor for prostate cancer: Meta-analysis of case-control studies. *Nutr Cancer. 2004;48(1):22–27.*

[64] Qin LQ, Xu JY, Wang PY, Tong J, Hoshi K. Milk consumption is a risk factor for prostate cancer in Western countries: evidence from cohort studies. *Asia Pac J Clin Nutr. 2007;16(3):467 – 476.*

[65] van der Pols JC, Bain C, Gunnell D, Smith GD, Frobisher C, Martin RM. Childhood dairy intake and adult cancer risk: 65-y follow-up of the boyd orr cohort. *American Journal of Clinical Nutrition. 2007;86(6):1722.*

[66] Tate PL, Bibb R, Larcom LL. Milk stimulates growth of prostate cancer cells in culture. *Nutr Cancer. 2011;63(8):1361–1366.*

[67] Allen NE, Appleby PN, Davey GK, Kaaks R, Rinaldi S, Key TJ. The associations of diet with serum insulin-like growth factor I and its main binding proteins in 292 women meat-eaters, vegetarians, and vegans. *Cancer Epidemiol Biomarkers Prev. 2002 Nov;11(11):1441-8.*

- [68] Dewell A, Weidner, Sumner MD, Barnard RJ, Marlin RO, Daubenmier JJ, Chi C, Carroll PR, Ornish D. Relationship of dietary protein and soy isoflavones to serum IGF-1 and IGF binding proteins in the Prostate Cancer Lifestyle Trial. *Nutr Cancer*. 2007;58(1):35-42.
- [69] Sun Q, Ma J, Campos H, Hu FB. Plasma and erythrocyte biomarkers of dairy fat intake and risk of ischemic heart disease. *American Journal of Clinical Nutrition*. 2007;86(4):929.
- [70] National Cancer Institute. 2010. Top Food Sources of Saturated Fat among US Population.
http://appliedresearch.cancer.gov/diet/foodsources/sat_fat/sf.html
- [71] L T Ho-Pham, P L T Nguyen, T T T Le, T A T Doan, N T Tran, T A Le, and T V Nguyen. Veganism, bone mineral density, and body composition: A study in buddhist nuns. *Osteoporos Int*. 2009 Dec;20(12):2087-93. doi: 10.1007/s00198-009-0916-z. Epub 2009 Apr 7.
- [72] López-González AA, Grases F, Monroy N, Mari B, Vicente-Herrero MT, Tur F, Perelló J. Protective effect of myo-inositol hexaphosphate (phytate) on bone mass loss in postmenopausal women. *Eur J Nutr*. 2013 Mar;52(2):717-26. doi: 10.1007/s00394-012-0377-6. Epub 2012 May 22.
- [73] López-González AA, Grases F, Roca P, Mari B, Vicente-Herrero MT, Costa-Bauzá A. Phytate (myo-inositol hexaphosphate) and risk factors for osteoporosis. *J Med Food*. 2008;11(4):747-752.
- [74] A A Lopez-Gonzalez, F Grases, J Perello, F Tur, A Costa-Bauza, N Monroy, B Mari, T Vicente-Herrero. Phytate levels and bone parameters: A retrospective pilot clinical trial. *Front Biosci (Elite Ed)*. 2010;2:1093-1098.
- [75] Gautam S, Platel K, Srinivasan K. Higher bioaccessibility of iron and zinc from food grains in the presence of garlic and onion. *J Agric Food Chem*. 2010 Jul 28;58(14):8426-9.
- [76] I Darmadi-Blackberry, M Wahlqvist, A Kouris-Blazos, et al. Legumes: the most important dietary predictor of survival in older people of different ethnicities. *Asia Pac J Clin Nutr*. 2004;13(2):217-20.
- [77] W Chang, M Wahlqvist, H Chang, C Hsu, M Lee, W Wang, C Hsiung. A bean-free diet increases the risk of all-cause mortality among Taiwanese women: The role of the metabolic syndrome. *Public Health Nutr*. 2012;15(4):663-672.

- [78] J Yao, C Qian. *Sporamin induce apoptosis in human tongue carcinoma cells by down-regulating Akt/GSK-3 signaling. Fundam Clin Pharmacol* 2011;25(2):229-236.
- [79] P G Li, T H Mu, L Deng. *Anticancer effects of sweet potato protein on human colorectal cancer cells. World J Gastroenterol.* 2013;19(21):3300–3308.
- [80] De Mejía EG, Prisecaru VI. *Lectins as bioactive plant proteins: a potential in cancer treatment. Crit Rev Food Sci Nutr.* 2005;45(6):425-45.
- [81] A Lopez, T El-Naggar, M Duenas, T Ortega, I Estrella, T Hernandez, M P Gomez-Serranillos, O M Palomino, M E Carretero. *Effect of cooking and germination on phenolic composition and biological properties of dark beans (Phaseolus vulgaris L.). Food Chem.* 2013 May 1;138(1):547-55.
- [82] T M Wolever, D J Jenkins, A M Ocana, V A Rao, G R Collier. *Second-meal effect: Low-glycemic-index foods eaten at dinner improve subsequent breakfast glycemic response. Am J Clin Nutr.* 1988;48(4):1041-1047.
- [83] Ferdowsian HR, Barnard ND, Hoover VJ, Katcher HI, Levin SM, Green AA, Cohen JL. *A multicomponent intervention reduces body weight and cardiovascular risk at a GEICO corporate site. Am J Health Promot.* 2010 Jul-Aug;24(6):384-7. doi: 10.4278/ajhp.081027-QUAN-255.
- [84] Turner-McGrievy GM, Barnard ND, Scialli AR. *A two-year randomized weight loss trial comparing a vegan diet to a more moderate low-fat diet. Obesity (Silver Spring).* 2007 Sep;15(9):2276-81.
- [85] Turner-McGrievy GM, Davidson CR, Wingard EE, Wilcox S, Frongillo EA. *Comparative effectiveness of plant-based diets for weight loss: a randomized controlled trial of five different diets. Nutrition.* 2015 Feb;31(2):350-8. doi: 10.1016/j.nut.2014.09.002. Epub 2014 Oct 18.
- [86] Jiménez-Monreal AM, García-Diz L, Martínez-Tomé M, Mariscal M, Murcia MA. *Influence of cooking methods on antioxidant activity of vegetables. J Food Sci.* 2009 Apr;74(3):H97-H103.
- [87] R J Merritt, B H Jenks. *Safety of Soy-Based Infant Formulas Containing Isoflavones: The Clinical Evidence. J Nutr.* 2004 May;134(5):1220S-1224S.
- [88] S L Tilghman, S M Boué, M E Burow. *Glyceollin I, a Novel Antiestrogenic Phytoalexin Isolated from Activated Soy. J Pharmacol Exp Ther.* 2010 Jan; 332(1):35-45.

- [89] Lu K, Yang J, Li D-C, et al. Expression and clinical significance of glucose transporter-1 in pancreatic cancer. *Oncology Letters*. 2016;12(1):243-249. doi:10.3892/ol.2016.4586.
- [90] Liu X, Du X, Han G, Gao W. Association between tea consumption and risk of cognitive disorders: A dose-response meta-analysis of observational studies. *Oncotarget*. 2017;8(26):43306-43321. doi:10.18632/oncotarget.17429.
- [91] Guo Y, Zhi F, Chen P, et al. Green tea and the risk of prostate cancer: A systematic review and meta-analysis. *Arora. S, ed. Medicine*. 2017;96(13):e6426. doi:10.1097/MD.00000000000006426.
- [92] Xiong J, Lin J, Wang A, et al. Tea consumption and the risk of biliary tract cancer: a systematic review and dose-response meta-analysis of observational studies. *Oncotarget*. 2017;8(24):39649-39657. doi:10.18632/oncotarget.16963.
- [93] Zhan X, Wang J, Pan S, Lu C. Tea consumption and the risk of ovarian cancer: A meta-analysis of epidemiological studies. *Oncotarget*. 2017;8(23):37796-37806. doi:10.18632/oncotarget.16890.
- [94] Sun K, Wang L, Ma Q, Cui Q, Lv Q, Zhang W, Li X. Association between tea consumption and osteoporosis: A meta-analysis. *Medicine (Baltimore)*. 2017 Dec;96(49):e9034. doi:10.1097/MD.00000000000009034.
- [95] Fon Sing M, Yang WS, Gao S, Gao J, Xiang YB. Epidemiological studies of the association between tea drinking and primary liver cancer: a meta-analysis. *Eur J Cancer Prev*. 2011 May;20(3):157-65. doi: 10.1097/CEJ.0b013e3283447497.
- [96] Wnuk M, Lewinska A, Oklejewicz B, Bugno M, Słota E, Bartosz G. Evaluation of the cyto- and genotoxic activity of yerba mate (*Ilex paraguariensis*) in human lymphocytes in vitro. *Mutat Res*. 2009 Sep-Oct;679(1-2):18-23. doi: 10.1016/j.mrgentox.2009.07.017.
- [97] Larsson SC. Coffee, tea, and cocoa and risk of stroke. *Stroke*. 2014 Jan;45(1):309-14. doi: 10.1161/STROKEAHA.113.003131. Epub 2013 Dec 10.
- [98] Grosso G, Godos J, Galvano F, Giovannucci EL. Coffee, Caffeine, and Health Outcomes: An Umbrella Review. *Annu Rev Nutr*. 2017 Aug 21;37:131-156. doi: 10.1146/annurev-nutr-071816-064941.

- [99] Dranoff JA. Coffee Consumption and Prevention of Cirrhosis - In Support of the Caffeine Hypothesis. *Gene Expr.* 2017 Sep 11. doi: 10.3727/105221617X15046391179559.
- [100] Gökçen BB, Şanlıer N. Coffee consumption and disease correlations. *Crit Rev Food Sci Nutr.* 2017 Aug 30;1-13. doi: 10.1080/10408398.2017.1369391
- [101] Rendón MY, Dos Santos Scholz MB, Bragagnolo N. Is cafestol retained on the paper filter in the preparation of filter coffee? *Food Res Int.* 2017 Oct;100(Pt 1):798-803. doi: 10.1016/j.foodres.2017.08.013. Epub 2017 Aug 5.
- [102] Natella F, Nardini M, Belevi F, Scaccini C. Coffee drinking induces incorporation of phenolic acids into LDL and increases the resistance of LDL to ex vivo oxidation in humans. *Am J Clin Nutr.* 2007 Sep;86(3):604-9.
- [103] Panagiotakos DB, Pitsavos C, Zampelas A, Zeimbekis A, Chrysohou C, Papademetriou L, Stefanadis C. The association between coffee consumption and plasma total homocysteine levels: the "ATTICA" study. *Heart Vessels.* 2004 Nov;19(6):280-6.
- [104] Corrêa TA, Rogero MM, Mito BM, Tarasoutchi D, Tuda VL, César LA, Torres EA. Paper-filtered coffee increases cholesterol and inflammation biomarkers independent of roasting degree: a clinical trial. *Nutrition.* 2013 Jul-Aug;29(7-8):977-81. doi: 10.1016/j.nut.2013.01.003. Epub 2013 Mar 17.
- [105] Gökçen BB, Şanlıer N. Coffee consumption and disease correlations. *Crit Rev Food Sci Nutr.* 2017 Aug 30;1-13. doi: 10.1080/10408398.2017.1369391
- [106] Arab L. Epidemiologic evidence on coffee and cancer. *Nutr Cancer.* 2010;62(3):271-83. doi: 10.1080/01635580903407122.
- [107] Nakayama T, Funakoshi-Tago M, Tamura H. Coffee reduces KRAS expression in Caco-2 human colon carcinoma cells via regulation of miRNAs. *Oncol Lett.* 2017 Jul;14(1):1109-1114. doi:10.3892/ol.2017.6227. Epub 2017 May 22.
- [108] Lantz I, Ternité R, Wilkens J, Hoenicke K, Guenther H, van der Stegen GH. Studies on acrylamide levels in roasting, storage and brewing of coffee. *Mol Nutr Food Res.* 2006 Nov;50(11):1039-46.

- [109] Mojska H, Gielecińska I. Studies of acrylamide level in coffee and coffee substitutes: influence of raw material and manufacturing conditions. *Rocz Panstw Zakl Hig.* 2013;64(3):173-81.
- [110] Poole R, Kennedy OJ, Roderick P, Fallowfield JA, Hayes PC, Parkes J. Coffee consumption and health: umbrella review of meta-analyses of multiple health outcomes. *The BMJ.* 2017;359:j5024. doi:10.1136/bmj.j5024.
- [111] Benson NU, Akintokun OA, Adedapo AE. Disinfection Byproducts in Drinking Water and Evaluation of Potential Health Risks of Long-Term Exposure in Nigeria. *Journal of Environmental and Public Health.* 2017;2017:7535797. doi:10.1155/2017/7535797.
- [112] Morris RD, Audet AM, Angelillo IF, Chalmers TC, Mosteller F. Chlorination, chlorination by-products, and cancer: a meta-analysis. *American Journal of Public Health.* 1992;82(7):955-963.
- [113] Morris RD. Drinking water and cancer. *Environmental Health Perspectives.* 1995;103(Suppl 8):225-231.
- [114] Salas LA, Bustamante M, Gonzalez JR, et al. DNA methylation levels and long-term trihalomethane exposure in drinking water: an epigenome-wide association study. *Epigenetics.* 2015;10(7):650-661. doi:10.1080/15592294.2015.1057672.
- [115] Stote KS, Baer DJ, Spears K, et al. A controlled trial of reduced meal frequency without caloric restriction in healthy, normal-weight, middle-aged adults. *The American journal of clinical nutrition.* 2007;85(4):981-988.
- [116] M L Bierenbaum, A I Fleischman, J P Dunn, T Hayton, D C Pattison, P B Watson. Serum Parameters in Hard and Soft Water Communities. *Am J Public Health.* 1973 Feb;63(2):169–173.
- [117] Shaper AG, Packham RF, Pocock SJ. The British Regional Heart Study: cardiovascular mortality and water quality. *J Environ Pathol Toxicol.* 1980 Sep;4(2-3):89-111.
- [118] R L Calderon, G F Craun. Water Hardness and Cardiovascular Disease: a Review of the Epidemiological Studies, 1957-78. WHO - Nutrients in Drinking Water. 2005:116-126.
- [119] S Monarca, F Donato, M Zerbini. Drinking Water Hardness and Cardiovascular Disease: a Review of the Epidemiological Studies 1979-2004. WHO - Nutrients in Drinking Water. 2005:127-147.

- [120] Bernard Rosner, PhD, Nancy R. Cook, ScD, Stephen Daniels, MD, PhD, and Bonita Falkner, MD. *Childhood Blood Pressure Trends and Risk Factors for High Blood Pressure: The NHANES experience 1988–2008. Hypertension. 2013 Aug;62(2):247–254. doi: 10.1161/HYPERTENSIONAHA.111.00831. Epub 2013 Jul 15.*
- [121] Khaw KT, Bingham S, Welch A, Luben R, O'Brien E, Wareham N, Day N. *Blood pressure and urinary sodium in men and women: the Norfolk Cohort of the European Prospective Investigation into Cancer (EPIC-Norfolk). Am J Clin Nutr. 2004 Nov;80(5):1397-403.*
- [122] J Stamler. *The INTERSALT Study: background, methods, findings, and implications. Am J Clin Nutr. 1997 Feb;65(2):626S-642S.*
- [123] Mancilha-Carvalho Jde J, Souza e Silva NA. *The Yanomami Indians in the INTERSALT Study. Arq Bras Cardiol. 2003 Mar;80(3):289-300.*
- [124] Denton D, Weisinger R, Mundy NI et al. *The effect of increased salt intake on blood pressure of chimpanzees. Nat Med 1995;1:1009–16.*
- [125] Walkowska A, Kuczeriszka M, Sadowski J, Olszyński K H, Dobrowolski L, Červenka L, Hammock B D, Kompanowska-Jezierska E. *High Salt Intake Increases Blood Pressure in Normal Rats: Putative Role of 20-HETE and No Evidence on Changes in Renal Vascular Reactivity. Kidney Blood Press Res 2015;40:323-334 doi: 10.1159/000368508.*
- [126] Johnson AG, Nguyen TV, Davis D. *Blood pressure is linked to salt intake and modulated by the angiotensinogen gene in normotensive and hypertensive elderly subjects. J Hypertens. 2001 Jun;19(6):1053-60.*
- [127] MacGregor GA, Markandu ND, Sagnella GA, Singer DR, Cappuccio FP. *Double-blind study of three sodium intakes and long-term effects of sodium restriction in essential hypertension. Lancet. 1989 Nov 25;2(8674):1244-7.*
- [128] Sacks FM, Svetkey LP, Vollmer WM, Appel LJ, Bray GA, Harsha D, Obarzanek E, Conlin PR, Miller ER 3rd, Simons-Morton DG, Karanja N, Lin PH; DASH-Sodium Collaborative Research Group. *Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) diet. DASH-Sodium Collaborative Research Group. N Engl J Med. 2001 Jan 4;344(1):3-10.*
- [129] P. Jousilahti, K. Harald, A. Jula1, T. Laatikainen, S. Mannisto, M. Peltonen, M. Perola, P. Puska, V. Salomaa, J. Tuomilehto, L. Valsta, E. Vartiainen, National Institute for Health and Welfare-THL - Helsinki -

- Finland. Salt intake and the risk of heart failure. *Euro Heart J* 2017 Aug 29;38:240 doi: 10.1093/eurheartj/ehx502.1192.
- [130] Karppanen H, Mervaala E. Sodium intake and hypertension. *Prog Cardiovasc Dis*. 2006 Sep-Oct;49(2):59-75.
- [131] P Strazzullo, L D'Elia, N Kandala, F P Cappuccio. Salt intake, stroke, and cardiovascular disease: meta-analysis of prospective studies. *BMJ* 2009;339:b4567 doi: 10.1136/bmj.b4567.
- [132] Yang Q, Liu T, Kuklina EV, Flanders WD, Hong Y, Gillespie C, Chang MH, Gwinn M, Dowling N, Khoury MJ, Hu FB. Sodium and Potassium Intake and Mortality Among US Adults Prospective Data From the Third National Health and Nutrition Examination Survey. *Arch Intern Med*. 2011 Jul 11;171(13):1183-91. doi: 10.1001/archinternmed.2011.257.
- [133] Haycock GB. The influence of sodium on growth in infancy. *Pediatr Nephrol*. 1993 Dec;7(6):871-5.
- [134] D Bowie. Ion-dependent gating of kainate receptors. *J Physiol*. 2010 Jan 1;588(Pt 1):67–81. doi: 10.1113/jphysiol.2009.178863 Epub 2009 Oct 12.
- [135] B A McCool, PhD, D T Christian, MS, M R Diaz, PhD, A K Läck, PhD. Glutamate Plasticity in the Drunken Amygdala: the Making of an Anxious Synapse. *Int Rev Neurobiol*. 2010;91:205–233. doi: 10.1016/S0074-7742(10)91007-6.
- [136] Rush TM, Kritz-Silverstein D, Laughlin GA, Fung TT, Barrett-Connor EL, McEvoy LK. Association between Dietary Sodium Intake and Cognitive Function in Older Adults. *J Nutr Health Aging*. 2017;21(3):276-283. doi: 10.1007/s12603-016-0766-2.
- [137] A J Fiocco, B Shatenstein, G Ferland, H Payette, S Belleville, M Kergoat, J A Morais, C E Greenwood. Sodium intake and physical activity impact cognitive maintenance in older adults: the NuAge Study. *Neurobiol Aging*. 2012 Apr;33(4):829.e21-8. doi: 10.1016/j.neurobiolaging.2011.07.004. Epub 2011 Aug 19.
- [138] Oliver WJ, Cohen EL, Neel JV. Blood pressure, sodium intake, and sodium related hormones in the Yanomamo Indians, a "no-salt" culture. *Circulation*. 1975 Jul;52(1):146-51.
- [139] Fliser D, Fode P, Arnold U, Nowicki M, Kohl B, Ritz E. The effect of dietary salt on insulin sensitivity. *Eur J Clin Invest*. 1995 Jan;25(1):39-43.

- [140] Rivellese AA, De Natale C, Lilli S. Type of dietary fat and insulin resistance. *Ann N Y Acad Sci.* 2002 Jun;967:329-35.
- [141] von Frankenberg AD, Marina A, Song X, Callahan HS, Kratz M, Utzschneider KM. A high-fat, high-saturated fat diet decreases insulin sensitivity without changing intra-abdominal fat in weight-stable overweight and obese adults. *Eur J Nutr.* 2017 Feb;56(1):431-443. Epub 2015 Nov 28. doi: 10.1007/s00394-015-1108-6.
- [142] Yiran Li, Shimeng Xu, Xuelin Zhang, Zongchun Yi, Simon Cichello. Skeletal intramyocellular lipid metabolism and insulin resistance. *Biophys Rep.* 2015;1:90–98. Epub 2015 Oct 23. doi: 10.1007/s41048-015-0013-0.
- [143] Lee S, Boesch C, Kuk JL, Arslanian S. Effects of an overnight intravenous lipid infusion on intramyocellular lipid content and insulin sensitivity in African-American versus Caucasian adolescents. *Metabolism.* 2013 Mar;62(3):417-23. Epub 2012 Nov 1. doi: 10.1016/j.metabol.2012.09.007.
- [144] J Park, C K Kwock. Sodium intake and prevalence of hypertension, coronary heart disease, and stroke in Korean adults. *J Ethnic Foods.* 2015 Sep;2(3):92-96. doi: 10.1016/j.jef.2015.08.007.
- [145] H J Song, H-J Lee. Consumption of kimchi, a salt fermented vegetable, is not associated with hypertension prevalence. *J Ethnic Foods.* 2014 Dec;1(1):8-12. doi: 10.1016/j.jef.2014.11.004.
- [146] Shim E, Ryu H-J, Hwang J, Kim SY, Chung E-J. Dietary sodium intake in young Korean adults and its relationship with eating frequency and taste preference. *Nutrition Research and Practice.* 2013;7(3):192-198. doi: 10.4162/nrp.2013.7.3.192.
- [147] O'Donnell M, Mente A, Rangarajan S, McQueen MJ, Wang X, Liu L, Yan H, Lee SF, Mony P, Devanath A, Rosengren A, Lopez-Jaramillo P, Diaz R, Avezum A, Lanas F, Yusuf K, Iqbal R, Ilow R, Mohammadifard N, Gulec S, Yusufali AH, Kruger L, Yusuf R, Chifamba J, Kabali C, Dagenais G, Lear SA, Teo K, Yusuf S; PURE Investigators. Urinary sodium and potassium excretion, mortality, and cardiovascular events. *N Engl J Med.* 2014 Aug 14;371(7):612-23. doi: 10.1056/NEJMoa1311889.
- [148] Mente A, O'Donnell MJ, Rangarajan S, McQueen MJ, Poirier P, Wielgosz A, Morrison H, Li W, Wang X, Di C, Mony P, Devanath A, Rosengren A, Oguz A, Zatonska K, Yusufali AH, Lopez-Jaramillo P, Avezum A, Ismail N, Lanas F, Puoane T, Diaz R, Kelishadi R, Iqbal R, Yusuf R, Chifamba J, Khatib R, Teo K, Yusuf S; PURE Investigators.

- Association of urinary sodium and potassium excretion with blood pressure. *N Engl J Med*. 2014 Aug 14;371(7):601-11. doi: 10.1056/NEJMoa1311989.
- [149] Mozaffarian D1, Fahimi S, Singh GM, Micha R, Khatibzadeh S, Engell RE, Lim S, Danaei G, Ezzati M, Powles J; Global Burden of Diseases Nutrition and Chronic Diseases Expert Group. Global sodium consumption and death from cardiovascular causes. *N Engl J Med*. 2014 Aug 14;371(7):624-34. doi: 10.1056/NEJMoa1304127.
- [150] Dougher CE, Rifkin DE, Anderson CA, Smits G, Persky MS, Block GA, Ix JH. Spot urine sodium measurements do not accurately estimate dietary sodium intake in chronic kidney disease. *Am J Clin Nutr*. 2016 Aug;104(2):298-305. doi: 10.3945/ajcn.115.127423. Epub 2016 Jun 29.
- [151] Chang HY, Hu YW, Yue CS, Wen YW, Yeh WT, Hsu LS, Tsai SY, Pan WH. Effect of potassium-enriched salt on cardiovascular mortality and medical expenses of elderly men. *Am J Clin Nutr*. 2006 Jun;83(6):1289-96.
- [152] Cook NR, Cutler JA, Obarzanek E, Buring JE, Rexrode KM, Kumanyika SK, Appel LJ, Whelton PK. Long term effects of dietary sodium reduction on cardiovascular disease outcomes: observational follow-up of the trials of hypertension prevention (TOHP). *BMJ*. 2007 Apr 28;334(7599):885-8. Epub 2007 Apr 20.
- [153] Cook NR, Appel LJ, Whelton PK. Sodium Intake and All-Cause Mortality Over 20 Years in the Trials of Hypertension Prevention. *J Am Coll Cardiol*. 2016 Oct 11;68(15):1609-1617. doi: 10.1016/j.jacc.2016.07.745.
- [154] M'Buyamba-Kabangu JR, Fagard R, Lijnen P, Staessen J, Ditu MS, Tshiani KA, Amery A. Epidemiological study of blood pressure and hypertension in a sample of urban Bantu of Zaïre. *J Hypertens*. 1986 Aug;4(4):485-91.
- [155] Lindeberg S, Lundh B. Apparent absence of stroke and ischaemic heart disease in a traditional Melanesian island: a clinical study in Kitava. *J Intern Med*. 1993 Mar;233(3):269-75.
- [156] Lindeberg S, Nilsson-Ehle P, Terént A, Vessby B, Scherstén B. Cardiovascular risk factors in a Melanesian population apparently free from stroke and ischaemic heart disease: the Kitava study. *J Intern Med*. 1994 Sep;236(3):331-40.

- [157] Kontessis P, Jones S, Dodds R, Trevisan R, Nosadini R, Fioretto P, Borsato M, Sacerdoti D, Viberti G. Renal, metabolic and hormonal responses to ingestion of animal and vegetable proteins. *Kidney Int.* 1990 Jul;38(1):136-44.
- [158] Wiwanitkit V. Renal function parameters of Thai vegans compared with non-vegans. *Ren Fail.* 2007;29(2):219-20.
- [159] Barsotti G, Morelli E, Cupisti A, Meola M, Dani L, Giovannetti S. A low-nitrogen low-phosphorus Vegan diet for patients with chronic renal failure. *Nephron.* 1996;74(2):390-4.
- [160] Tonstad S, Nathan E, Oda K, Fraser G. Vegan Diets and Hypothyroidism. *Nutrients.* 2013;5(11):4642-4652. doi: 10.3390/nu5114642.
- [161] Shan-shan Shao, Yuan-fei Zhao, Yong-feng Song, Chao Xu, Jian-mei Yang, Shi-meng Xuan, Hui-li Yan, Chun-xiao Yu, Meng Zhao, Jin Xu, Jia-jun Zhao. Dietary high-fat lard intake induces thyroid dysfunction and abnormal morphology in rats. *Acta Pharmacol Sin.* 2014 Nov; 35(11): 1411–1420. Epub 2014 Sep 29. doi: 10.1038/aps.2014.82
- [162] Han H, Xin P, Zhao L, Xu J, Xia Y, Yang X, Sun X, Hao L. Excess iodine and high-fat diet combination modulates lipid profile, thyroid hormone, and hepatic LDLr expression values in mice. *Biol Trace Elem Res.* 2012 Jun;147(1-3):233-9. Epub 2012 Jan 6. doi: 10.1007/s12011-011-9300-x.
- [163] Felker P, Bunch R, Leung AM. Concentrations of thiocyanate and goitrin in human plasma, their precursor concentrations in brassica vegetables, and associated potential risk for hypothyroidism. *Nutr Rev.* 2016 Apr;74(4):248-58. Epub 2016 Mar 5. doi: 10.1093/nutrit/nuv110.
- [164] Shapiro TA, Fahey JW, Dinkova-Kostova AT, Holtzclaw WD, Stephenson KK, Wade KL, Ye L, Talalay P. Safety, tolerance, and metabolism of broccoli sprout glucosinolates and isothiocyanates: a clinical phase I study. *Nutr Cancer.* 2006;55(1):53-62.
- [165] McMillan M, Spinks EA, Fenwick GR. Preliminary observations on the effect of dietary brussels sprouts on thyroid function. *Hum Toxicol.* 1986 Jan;5(1):15-9.
- [166] Wang L, Tian Z, Yang Q, Li H, Guan H, Shi B, Hou P, Ji M. Sulforaphane inhibits thyroid cancer cell growth and invasiveness through the reactive oxygen species-dependent pathway. *Oncotarget.* 2015 Sep 22;6(28):25917-31. doi: 10.18632/oncotarget.4542.

- [167] Messina M, Redmond G. Effects of soy protein and soybean isoflavones on thyroid function in healthy adults and hypothyroid patients: a review of the relevant literature. *Thyroid*. 2006 Mar;16(3):249-58.
- [168] Teas J, Braverman LE, Kurzer MS, Pino S, Hurley TG, Hebert JR. Seaweed and soy: companion foods in Asian cuisine and their effects on thyroid function in American women. *J Med Food*. 2007 Mar;10(1):90-100.
- [169] S. Sadasivan, S.J.S. Anand. Chlorine, bromine and iodine in monsoon rains in India. *Tellus*. 1979;31:290-294.
- [170] Sang Z, Wang PP, Yao Z, Shen J, Halfyard B, Tan L, Zhao N, Wu Y, Gao S, Tan J, Liu J, Chen Z, Zhang W. Exploration of the safe upper level of iodine intake in euthyroid Chinese adults: a randomized double-blind trial. *Am J Clin Nutr*. 2012 Feb;95(2):367-73. doi: 10.3945/ajcn.111.028001. Epub 2011 Dec 28.
- [171] Zava TT, Zava DT. Assessment of Japanese iodine intake based on seaweed consumption in Japan: A literature-based analysis. *Thyroid Research*. 2011;4:14. doi: 10.1186/1756-6614-4-14.
- [172] Kasagi K, Takahashi N, Inoue G, Honda T, Kawachi Y, Izumi Y. Thyroid function in Japanese adults as assessed by a general health checkup system in relation with thyroid-related antibodies and other clinical parameters. *Thyroid*. 2009 Sep;19(9):937-44. doi: 10.1089/thy.2009.0205.
- [173] Blomberg M, Feldt-Rasmussen U, Andersen KK, Kjaer SK. Thyroid cancer in Denmark 1943-2008, before and after iodine supplementation. *Int J Cancer*. 2012 Nov 15;131(10):2360-6. doi: 10.1002/ijc.27497. Epub 2012 Mar 20.
- [174] Wenwu Dong, Hao Zhang, Ping Zhang, Xuan Li, Liang He, Zhihong Wang, Yongfeng Liu. The changing incidence of thyroid carcinoma in Shenyang, China before and after universal salt iodization. *Med Sci Monit*. 2013;19:49–53. Epub 2013 Jan 14. doi: 10.12659/MSM.883736.
- [175] Michikawa T, Inoue M, Shimazu T, Sawada N, Iwasaki M, Sasazuki S, Yamaji T, Tsugane S; Japan Public Health Center-based Prospective Study Group. Seaweed consumption and the risk of thyroid cancer in women: the Japan Public Health Center-based Prospective Study. *Eur J Cancer Prev*. 2012 May;21(3):254-60. doi: 10.1097/CEJ.0b013e32834a8042.

- [176] Wang C, Yatsuya H, Li Y, Ota A, Tamakoshi K, Fujino Y, Mikami H, Iso H, Tamakoshi A; JACC Study Group. Prospective study of seaweed consumption and thyroid cancer incidence in women: the Japan collaborative cohort study. *Eur J Cancer Prev*. 2016 May;25(3):239-45. doi: 10.1097/CEJ.0000000000000168.
- [177] Ma J, Huang M, Wang L, Ye W, Tong Y, Wang H. Obesity and Risk of Thyroid Cancer: Evidence from a Meta-Analysis of 21 Observational Studies. *Med Sci Monit*. 2015;21:283-291. Epub 2015 Jan 22. doi: 10.12659/MSM.892035.
- [178] Ren Q, Fan J, Zhang Z, Zheng X, Delong GR. An environmental approach to correcting iodine deficiency: supplementing iodine in soil by iodination of irrigation water in remote areas. *J Trace Elem Med Biol*. 2008;22(1):1-8. Epub 2007 Oct 17. doi: 10.1016/j.jtemb.2007.09.003.
- [179] Qian M, Wang D, Watkins WE, Gebiski V, Yan YQ, Li M, Chen ZP. The effects of iodine on intelligence in children: a meta-analysis of studies conducted in China. *Asia Pac J Clin Nutr*. 2005;14(1):32-42.
- [180] Leung AM, Pearce EN, Braverman LE. Iodine content of prenatal multivitamins in the United States. *N Engl J Med*. 2009 Feb 26;360(9):939-40. doi: 10.1056/NEJMc0807851.
- [181] Smyth PP, Duntas LH. Iodine uptake and loss-can frequent strenuous exercise induce iodine deficiency? *Horm Metab Res*. 2005 Sep;37(9):555-8.
- [182] Zava T T, Zava D T. Assessment of Japanese iodine intake based on seaweed consumption in Japan: A literature-based analysis. *Thyroid Research*. 2011;4:14. doi: 10.1186/1756-6614-4-14.
- [183] Dasgupta PK, Liu Y, Dyke JV. Iodine nutrition: iodine content of iodized salt in the United States. *Environ Sci Technol*. 2008 Feb 15;42(4):1315-23.
- [184] Li R, Liu HP, Hong CL, Dai ZX, Liu JW, Zhou J, Hu CQ, Weng HX. Iodide and iodate effects on the growth and fruit quality of strawberry. *J Sci Food Agric*. 2017 Jan;97(1):230-235. Epub 2016 Apr 28. doi: 10.1002/jsfa.7719.
- [185] Mao IF, Chen ML, Ko YC. Electrolyte loss in sweat and iodine deficiency in a hot environment. *Arch Environ Health*. 2001 May-Jun;56(3):271-7.

- [186] Yukawa M, Amano K, Suzuki-Yasumoto M, Terai M. Distribution of trace elements in the human body determined by neutron activation analysis. *Arch Environ Health*. 1980 Jan-Feb;35(1):36-44.
- [187] Shiheng Lyu, Xiangying Wei, Jianjun Chen, Cun Wang, Xiaoming Wang, Dongming Pan. Titanium as a Beneficial Element for Crop Production. *Front Plant Sci*. 2017;8:597. Epub 2017 Apr 25. doi: 10.3389/fpls.2017.00597.
- [188] DeRuisseau KC, Cheuvront SN, Haymes EM, Sharp RG. Sweat iron and zinc losses during prolonged exercise. *Int J Sport Nutr Exerc Metab*. 2002 Dec;12(4):428-37.
- [189] Chen Z-H , Zhao Y-G , WU J-N. Status of iodine content of common foods in different geographical areas in Fujian Province. *Chinese J Endemiology*. 2013;32(3):276-280. doi: 10.3760/cma.j.issn.2095-4255.2013.03.011.
- [190] Dahl L, Johansson L, Julshamn K, Meltzer H M. The iodine content of Norwegian foods and diets. *Public Health Nutri*. 2004;7(4):569–576. Epub 2007 Jan 01. doi: 10.1079/PHN2003554.
- [191] Mokhort T, Kolomiets N, Fedorenko E, Mokhort A. Nutriciological monitoring of iodine status as a measure of iodine deficiency prevention. *Endocrine Abstracts*. 2014;35:P1026.
- [192] Cerretani L, Comandini P, Fumanelli D, Scazzina F, Chiavaro E. Evaluation of iodine content and stability in recipes prepared with biofortified potatoes. *Int J Food Sci Nutr*. 2014 Nov;65(7):797-802. Epub 2014 May 15. doi: 10.3109/09637486.2014.917155.
- [193] McClendon J F, Barrett E, Canniff T. The iodine content of potatoes. *Biochem J*. 1934;28(4):1209–1211.
- [194] Frear D E H. Study of the iodine content of Pennsylvania potatoes. *Jour Agr Res*. 1934;48(2):171–182.
- [195] Medrano-Macías J, Leija-Martínez P, González-Morales S, Juárez-Maldonado A, Benavides-Mendoza A. Use of Iodine to Biofortify and Promote Growth and Stress Tolerance in Crops. *Frontiers in Plant Science*. 2016;7:1146. Epub 2016 Aug 23. doi: 10.3389/fpls.2016.01146.
- [196] Lozovsky LI. Stable iodine in soils in Belarus in 1960s. *Microelements in the soils of BSSR and effectiveness of fertilizers*. 1971:224.
- [197] Fordyce F M. Database of the Iodine Content of Food and Diets Populated with Data from Published Literature. British Geological Survey.

2003;Report CR/03/84N:12.

[198] Taga I, Sameza ML, Kayo AV, Ngogang J. Iodine levels in food and soil in different regions in Cameroon. *Sante*. 2004 Jan-Mar;14(1):11-5.

[199] Ujowundu C O, Ukoha A I, Agha C N, Nwachukwu N, Igwe K O, Kalu F N. Effects of Potassium Iodate Application on the Biomass and Iodine concentration of Selected Indigenous Nigerian Vegetables. *African J Biotech*. 2010;9(42):7141-7.

[200] World Health Organization. Iodine in Drinking-water: Background document for development of WHO Guidelines for Drinking-water Quality. *Guidelines for drinking-water quality*. 1996;2:816.

[201] Lyn Patrick, ND. Iodine: Deficiency and Therapeutic Considerations. *Alter Med Review*. 2008;13(2):116-127.

[202] Chanoine J-P, MD. Selenium and thyroid function in infants, children and adolescents. *Biofactors*. 2003;19(3-4):137-143.

[203] Government of Canada. Canadian Nutrient File 2015. 2015:Database.

[204] Lunde G. Analysis of trace elements in seaweed. *J Sci Food Agric*. 1970;21(8):416-8.

[205] Lee D-C, Pate R, Lavie C, Sui X, Church T, Blair S. Leisure-Time Running Reduces All-Cause and Cardiovascular Mortality Risk. *J Am Coll Cardiol*. 2014;64(5):472-81.

[206] Gibbons A. The Evolution of Diet: Some experts say modern humans should eat from a Stone Age menu. What's on it may surprise you. *National Geographic Magazine*.

<https://www.nationalgeographic.com/foodfeatures/evolution-of-diet/>

[207] Corbo R, Scacchi R. Apolipoprotein E (APOE) allele distribution in the world: Is APOE4 a 'thrifty' allele? *Ann Hum Genet*. 1999;63:301-10.

[208] Leonard WR, Snodgrass JJ, Robertson ML. Evolutionary Perspectives on Fat Ingestion and Metabolism in Humans. *Fat Detection: Taste, Texture, and Post Ingestive Effects*. CRC Press/Taylor & Francis. 2010; Chapter 1. <https://www.ncbi.nlm.nih.gov/books/NBK53561/>

[209] O'Donovan G, Lee I-M, Hamer M, Stamatakis E. Association of "Weekend Warrior" and Other Leisure Time Physical Activity Pattern With Risks for All-Cause, Cardiovascular Disease, and Cancer Mortality. *JAMA Intern Med*. 2017;177(3):335-42. Epub 2017 January 9. doi: 10.1001/jamainternmed.2016.8014.

- [210] Ha A, Ng J. Rope skipping increases bone mineral density at calcanei of pubertal girls in Hong Kong: A quasi-experimental investigation. *PloS one*. 2017;12(12):e0189085. doi: 10.1371/journal.pone.0189085.
- [211] Ravnholt T, Tybirk J, Jorgensen NR, Bangsbo J. High-intensity intermittent “5-10-15” running reduces body fat, and increases lean body mass, bone mineral density, and performance in untrained subjects. *Eur J Appl Physiol*. 2018 Jun;118(6):1221-30. Epub 2018 Mar 29. doi: 10.1007/s00421-018-3851-x.
- [212] Roberts D, Ouellet J-F, McBeth P, Kirkpatrick A, Dixon E, Ball C. The “weekend warrior”: Fact or fiction for major trauma? *Can J Surg*. 2014 Jun;57(3):E62-E68. doi: 10.1503/cjs.030812.
- [213] Psoinos C, Emhoff T, Sweeney W, Tseng J, Santry H. The dangers of being a “weekend warrior”: A new call for injury prevention efforts. *J Trauma Acute Care Surg*. 2012 Aug;73(2):469-73. doi: 10.1097/TA.0b013e318258437c.
- [214] Stamatakis E, Chau J, Pedisic Z, Bauman A, Macniven R, Coombs N, Hamer M. Are Sitting Occupations Associated with Increased All-Cause, Cancer, and Cardiovascular Disease Mortality Risk? A Pooled Analysis of Seven British Population Cohorts. *PloS One*. 2013 Sep;8(9):e73753.
- [215] Warren T, Barry V, Hooker S, Sui X, Church T, Blair S. Sedentary Behaviors Increases Risk of Cardiovascular Disease. *Med Sci Sports Exerc*. 2010 May;42(5):879-85. doi: 10.1249/MSS.0b013e3181c3aa7e.
- [216] Patel A, Bernstein L, Deka A, Feigelson H, Campbell P, Gapstur S, Colditz G, Thun M. Leisure Time Spent Sitting in Relation to Total Mortality in a Prospective Cohort of US Adults. *Am J Epidemiol*. 2010;172:419-29.
- [217] Rosso S, Sera F, Segnan N, Zanetti R. Sun exposure prior to diagnosis is associated with improved survival in melanoma patients: results from a long-term follow-up study of Italian patients. *Eur J Cancer*. 2008 Jun;44(9):1275-81. Epub 2008 Apr 10. doi: 10.1016/j.ejca.2008.03.009.
- [218] Berwick M, Armstrong BK, Ben-Porat L, Fine J, Kricker A, Eberle C, Barnhill R. Sun exposure and mortality from melanoma. *J Natl Cancer Inst*. 2005 Feb 2;97(3):195-9.

- [219] Huber A. *Ask the Expert: Is sun exposure the only cause of skin cancer?* Skin Cancer Foundation. <https://www.skincancer.org/skin-cancer-information/ask-the-experts/is-sun-exposure-the-only-cause-of-skin-cancer/>
- [220] Mathews MJ, Mathews EH, Mathews GE. Oral health and coronary heart disease. *BMC Oral Health*. 2016;16(1):122. Published 2016 Nov 15. doi:10.1186/s12903-016-0316-7
- [221] Joshipura KJ, Rimm EB, Douglass CW, Trichopoulos D, Ascherio A, Willett WC. Poor oral health and coronary heart disease. *J Dent Res*. 1996;75(9):1631-1636. doi:10.1177/00220345960750090301
- [222] Michaud DS, Liu Y, Meyer M, Giovannucci E, Joshipura K. Periodontal disease, tooth loss, and cancer risk in male health professionals: a prospective cohort study. *Lancet Oncol*. 2008;9(6):550-558. doi:10.1016/S1470-2045(08)70106-2
- [223] Tooth infection leads to 26-year-old California dad's death. <https://www.foxnews.com/health/tooth-infection-leads-to-26-year-old-california-dads-death>
- [224] Sheiham A, James WP. Diet and Dental Caries: The Pivotal Role of Free Sugars Reemphasized. *J Dent Res*. 2015;94(10):1341-1347. doi:10.1177/0022034515590377
- [225] Minton KL, Berry CW. Cariogenic potential of presweetened breakfast cereals. *Pediatr Dent*. 1985;7(4):282-286.
- [226] Sheiham A. Sugars and dental decay. *Lancet*. 1983;1(8319):282-284. doi:10.1016/s0140-6736(83)91696-3
- [227] Takara K, Ushijima K, Wada K, Iwasaki H, Yamashita M. Phenolic compounds from sugarcane molasses possessing antibacterial activity against cariogenic bacteria. *J Oleo Sci*. 2007;56(11):611-614. doi:10.5650/jos.56.611
- [228] Jain A, Bhaskar DJ, Gupta D, et al. Comparative evaluation of honey, chlorhexidine gluconate (0.2%) and combination of xylitol and chlorhexidine mouthwash (0.2%) on the clinical level of dental plaque: A 30 days randomized control trial. *Perspect Clin Res*. 2015;6(1):53-57. doi:10.4103/2229-3485.148819
- [229] Nayak PA, Nayak UA, Mythili R. Effect of Manuka honey, chlorhexidine gluconate and xylitol on the clinical levels of dental plaque. *Contemp Clin Dent*. 2010;1(4):214-217. doi:10.4103/0976-237X.76386

- [230] Sela M, Maroz D, Gedalia I. *Streptococcus mutans* in saliva of normal subjects and neck and head irradiated cancer subjects after consumption of honey. *Journal of Oral Rehabilitation*. 2000;27:269-270. doi:10.1046/j.1365-2842.2000.00504.x
- [231] Ahmadi-Motamayel F, Rezaei-Soufi L, Kiani L, Alikhani MY, Poorolajal J, Moghadam M. Effects of honey, glucose, and fructose on the enamel demineralization depth, *Journal of Dental Sciences*. 2013;8(2):147-150. doi:10.1016/j.jds.2012.02.004
- [232] Kashket S, Van Houte J, Lopez LR, Stocks S. Lack of correlation between food retention on the human dentition and consumer perception of food stickiness. *J Dent Res*. 1991;70(10):1314-1319. doi:10.1177/00220345910700100101
- [233] Wong A, Young DA, Emmanouil DE, Wong LM, Waters AR, Booth MT. Raisins and oral health. *J Food Sci*. 2013;78 Suppl 1:A26-A29. Doi:10.1111/1750-3841.12152
- [234] Baumgartner S, Imfeld T, Schicht O, Rath C, Persson RE, Persson GR. The impact of the stone age diet on gingival conditions in the absence of oral hygiene. *J Periodontol*. 2009;80(5):759-768. doi:10.1902/jop.2009.080376
- [235] Stoy PJ. *Dental Disease and Civilisation. Inaugural Lecture in the Chair of Dentistry*. Queen's University of Belfast. 1950.
- [236] Drinkard C, Dilley MCH. Rampant caries as a result of a bizarre food habit: a case report. *The American Academy of Pedodontics*. 1982;4(2):131-134
- [237] Issa AI, Toumba KJ, Preston AJ, Duggal MS. Comparison of the effects of whole and juiced fruits and vegetables on enamel demineralisation in situ. *Caries Res*. 2011;45(5):448-452. doi:10.1159/000330597
- [238] Kunin AA, Belenova IA, Kupets TV. Evaluating the effectiveness of structural and metabolic tooth enamel reparation by magnesium-calcium remineralizing complex. *EPMA J*. 2014;5(Suppl 1):A122. Published 2014 Feb 11. doi:10.1186/1878-5085-5-S1-A122
- [239] Degli Esposti L, Ionescu AC, Brambilla E, Tampieri A, Iafisco M. Characterization of a Toothpaste Containing Bioactive Hydroxyapatites and In Vitro Evaluation of Its Efficacy to Remineralize Enamel and to Occlude Dentinal Tubules. *Materials*. 2020; 13(13):2928. doi:10.3390/ma13132928

- [240] Laffranchi L, Zotti F, Bonetti S, Dalessandri D, Fontana P. Oral implications of the vegan diet: observational study. *Minerva Stomatol.* 2010;59(11-12):583-591.
- [241] Kanchanadumkerng P, Wongsariya K. Effects of Natural Sugar on Acidogenic Potential, Biofilm Biomass, and Antiseptic Resistance of Oral Streptococci. *Current Applied Science and Technology (CAST).* Feb 2021;21(3). <https://li01.tci-thaijo.org/index.php/cast/article/view/248895>
- [242] Sayyedi A, Asgarian SH, Borazjani KH, Kohanteb J. Effect of Date Extract on Growth of Mutans Streptococci, the Most Important Factor of Dental Caries. *Armaghane Danesh.* 2007;11(4):63-71.
- [243] Armingohar Z, Jørgensen JJ, Kristoffersen AK, Abesha-Belay E, Olsen I. Bacteria and bacterial DNA in atherosclerotic plaque and aneurysmal wall biopsies from patients with and without periodontitis. *J Oral Microbiol.* 2014;6:10.3402/jom.v6.23408. Published 2014 May 15. doi:10.3402/jom.v6.23408
- [244] Frencken JE, Rugarabamu P, Mulder J. The effect of sugar cane chewing on the development of dental caries. *J Dent Res.* 1989;68(6):1102-1104. doi:10.1177/00220345890680060901
- [245] Thimothe J, Bonsi IA, Padilla-Zakour OI, Koo H. Chemical Characterization of Red Wine Grape (*Vitis vinifera* and *Vitis Interspecific Hybrids*) and Pomace Phenolic Extracts and Their Biological Activity against *Streptococcus mutans*. *J Agricultural and Food Chemistry.* 2007;55(25):10200-10207. doi:10.1021/jf0722405
- [246] Shetty V, Aswath NP, Hegde AM. Effect of crude apple extract on the cariogenic factors of *Streptococcus mutans*: An in vitro study. *J Indian Soc Pedod Prev Dent.* 2018;36(2):135-141. doi:10.4103/JISPPD.JISPPD_84_17
- [247] Nomura R, Ohata J, Otsugu M, Okawa R, Naka S, Matsumoto-Nakano M, Nakano K. Inhibitory effects of flavedo, albedo, fruits, and leaves of *Citrus unshiu* extracts on *Streptococcus mutans*. *Archives of Oral Biology.* 2021;124:105056. doi:10.1016/j.archoralbio.2021.105056.
- [248] Humphrey LT, Groote ID, Morales J, Barton N, Collicutt S, Ramsey CB, Bouzouggar A. Pleistocene caries and acorns. *Proceedings of the National Academy of Sciences.* Jan 2014;111(3):954-959. doi:10.1073/pnas.1318176111.
- [249] The History of Sugar. <https://www.sugar.org/sugar/history/>

- [250] McClure FJ. *Inhibition of experimental caries by oat hullss. Archives of Oral Biology.* 1964;9:219-221.
- [251] Stephen AM, Dahl WJ, Johns DM, Englyst HN. *Effect of Oat Hull Fiber on Human Colonic Function and Serum Lipids. Cereal Chemistry,* 1997;74:379-383. doi:10.1094/CCHEM.1997.74.4.379
- [252] Miake Y, Saeki Y, Takahashi M, Yanagisawa T. *Remineralization effects of xylitol on demineralized enamel. Journal of Electron Microscopy.* Nov 20 2003;52(5):471–476. doi:10.1093/jmicro/52.5.471.
- [253] Ur-Rehman S, Mushtaq Z, Zahoor T, Jamil A, Murtaza MA. *Xylitol: A Review on Bioproduction, Application, Health Benefits, and Related Safety Issues, Critical Reviews in Food Science and Nutrition.* 2015;55(11):1514-1528. doi:10.1080/10408398.2012.702288.
- [254] Pauli T, Mattila, Martti J, Svanberg, Kauko K, Mäkinen, Matti L. E. *Knuuttila, Dietary Xylitol, Sorbitol and D-Mannitol but not Erythritol Retard Bone Resorption in Rats, The Journal of Nutrition, Volume 126, Issue 7, July 1996, Pages 1865–1870, doi:10.1093/jn/126.7.1865*
- [255] Runnel R, Mäkinen KK, Honkala S, et al. *Effect of three-year consumption of erythritol, xylitol and sorbitol candies on various plaque and salivary caries-related variables. J Dent.* 2013;41(12):1236-1244. doi:10.1016/j.jdent.2013.09.007
- [256] Marya CM, Satija G, J A, Nagpal R, Kapoor R, Ahmad A. *In vitro inhibitory effect of clove essential oil and its two active principles on tooth decalcification by apple juice. Int J Dent.* 2012;2012:759618. doi:10.1155/2012/759618
- [257] Jaidka S, Somani R, Bajaj N, Jaidka R, Sharma S, Singh A. *Comparative Evaluation of Various Mouthwashes For Their Effect on Oral Health: An in-Vivo Study. Intern. J. of Oral Care and Research.* March 2015;3(1):56-62.
http://www.ijocrweb.com/pdf/2015/January-March/9222_Original%20Article.pdf
- [258] Fajriani, Mustamin AW; Asmawati. *The role of cacao extract in reduction of the number of mutans streptococci colonies in the saliva of 12-14 year-old-children. J Indian Soc Pedod Prev Dent.* 2016;34(2):120-123. doi:10.4103/0970-4388.180414
- [259] Tharakan AP, Pawar M, Kale S. *Effectiveness of licorice in preventing dental caries in children: A systematic review. J Indian Soc Pedod Prev Dent.* 2020;38:325-31.

- [260] Awadalla HI, Ragab MH, Bassuoni MW, Fayed MT, Abbas MO. A pilot study of the role of green tea use on oral health. *Int J Dent Hyg*. 2011;9(2):110-116. doi:10.1111/j.1601-5037.2009.00440.x
- [261] Hasan S, Danishuddin M, Adil M, Singh K, Verma PK, Khan AU. Efficacy of *E. officinalis* on the Cariogenic Properties of *Streptococcus mutans*: A Novel and Alternative Approach to Suppress Quorum-Sensing Mechanism. *PLoS ONE*. 2012;7(7): e40319. doi:10.1371/journal.pone.0040319
- [262] Hajiahmadi, Maryam & Yegdaneh, Afsaneh & Homayoni, Alireza & Parishani, Hossein & Moshkelgosha, Hadi & Salari-Moghaddam, Reza. Comparative Evaluation of Efficacy of "Green Tea" and "Green Tea with Xylitol" Mouthwashes on the Salivary *Streptococcus mutans* and *Lactobacillus* Colony Count in Children: A Randomized Clinical Trial. *The J. Contemporary Dental Practice*. 2019;20:1190-1194. doi:10.5005/jp-journals-10024-2652.
- [263] Arianto YKE, Triaminingsih S, Asada S, Saeki Y. Combination Concentration Effects of Calcium Hydrogenphosphate on Human Enamel Remineralization by Xylitol and Funoran. *Journal of International Dental and Medical Research*. 2016;9(3):189-194
- [264] Aripin D, Julaehe E, Dardjan M, Cahyanto A. Chemical composition of *Citrus* spp. and oral antimicrobial effect of *Citrus* spp. peels essential oils against *Streptococcus mutans*. *Padjadjaran Journal of Dentistry*, 2015;27(1): doi:10.24198/pjd.vol27no1.26751
- [265] Wu CC, Lin CT, Wu CY, Peng WS, Lee MJ, Tsai YC. Inhibitory effect of *Lactobacillus salivarius* on *Streptococcus mutans* biofilm formation. *Mol Oral Microbiol*. 2015;30:16-26. doi:10.1111/omi.12063.
- [266] Wasfi R, Abd El-Rahman OA, Zafer MM, Ashour HM. Probiotic *Lactobacillus* sp. inhibit growth, biofilm formation and gene expression of caries-inducing *Streptococcus mutans*. *J Cell Mol Med*. 2018;22:1972-1983. doi:10.1111/jcmm.13496
- [267] Lim SM, Lee NK, Paik HD. Antibacterial and anticavity activity of probiotic *Lactobacillus plantarum* 200661 isolated from fermented foods against *Streptococcus mutans*. *LWT*. 2020;118:108840. doi:10.1016/j.lwt.2019.108840.
- [268] Ahn KB, Baik JE, Park O-J, Yun C-H, Han SH. *Lactobacillus plantarum* lipoteichoic acid inhibits biofilm formation of *Streptococcus*

mutans. PLoS ONE. 2018;13(2):e0192694.

doi:10.1371/journal.pone.0192694

[269] Almeida AAP, Naghetini CC, Santos VR, Antonio AG, Farah A, Glória MBA. Influence of natural coffee compounds, coffee extracts and increased levels of caffeine on the inhibition of *Streptococcus mutans*, *Food Research International*. 2012;49(1):459-461.

doi:10.1016/j.foodres.2012.07.026

[270] Philip N, Leishman S, Bandara HMHN, Walsh L. Growth Inhibitory Effects of Antimicrobial Natural Products against Cariogenic and Health-Associated Oral Bacterial Species. *Oral Health Prev Dent* 2020;18(3):537-542. doi:10.3290/j.ohpd.a44307.

[271] Silver diammine fluoride.

https://en.wikipedia.org/wiki/Silver_diammine_fluoride

[272] Bioactive glass. https://en.wikipedia.org/wiki/Bioactive_glass

[273] Bitcomb T. The curious history of NovaMin toothpaste. *Medium*. Apr 2018. <https://medium.com/@ravenstine/the-curious-history-of-novamin-toothpaste-620c6bef8881>.

[274] Basting RT, Rodrigues AL Jr, Serra MC. The Effect of 10% Carbamide Peroxide, Carbopol and/or Glycerin on Enamel and Dentin Microhardness. *Operative Dentistry*. Sept/Oct 2005;30(5):608-616

[275] Haimanot R. Neurological complications of endemic skeletal fluorosis, with special emphasis on radiculo-myelopathy. *Spinal Cord* 1990;28:244–251. doi:10.1038/sc.1990.31.

[276] Valdez-Jiménez L, Soria Fregozo C, Miranda Beltrán ML, Gutiérrez Coronado O, Pérez Vega MI. Effects of the fluoride on the central nervous system. *Neurología (English Edition)*. 2011;26(5)297-300. doi:10.1016/S2173-5808(11)70062-1.

[277] Quock RL, Gao JX, Chan JT. Tea fluoride concentration and the pediatric patient. *Food Chemistry*. 2012;130(3):615-617. doi:10.1016/j.foodchem.2011.07.084.

[278] Zerabruk S, Chandravanshi BS, Zewge F. Fluoride in Black and Green Tea (*Camellia Sinensis*) Infusions In Ethiopia: Measurement and Safety Evaluati. *Bull. Chem. Soc. Ethiop*. 2010, 24(3), 327-338. https://www.waterethiopia.org/wp-content/uploads/2014/07/Chemical_Society_Ethiopia_1.pdf

[279] Amaechi BT, AbdulAzees PA, Alshareif DO, et al. Comparative efficacy of a hydroxyapatite and a fluoride toothpaste for prevention and

remineralization of dental caries in children. *BDJ Open*. 2019;5(18).

doi:10.1038/s41405-019-0026-8

[280] Chan A, Ellepola K, Truong T, Balan P, Koo H, Seneviratne CJ. Inhibitory effects of xylitol and sorbitol on *Streptococcus mutans* and *Candida albicans* biofilms are repressed by the presence of sucrose. *Arch Oral Biol*. 2020;119:104886. doi:10.1016/j.archoralbio.2020.104886

[281] Edwardsson S, Birkhed D, Mej   B. Acid production from Lycasin  , maltitol, sorbitol and xylitol by oral streptococci and lactobacilli, *Acta Odontologica Scandinavica*, 1977;35(5):257-263.

doi:10.3109/00016357709019801.

[282] Toors FA, Herczog JIB. Acid Production from a Nonsugar Licorice and Different Sugar Substitutes in *Streptococcus mutans* Monoculture and Pooled Plaque-Saliva Mixtures. *Caries Res* 1978;12:60-68. doi: 10.1159/000260316.

[283] Iwami Y, Takahashi-Abbe S, Takahashi N, Abbe K, Yamada T. Rate-limiting steps of glucose and sorbitol metabolism in *Streptococcus mutans* cells exposed to air. *Oral Microbiol Immunol*. 2000;15(5):325-328. doi:10.1034/j.1399-302x.2000.150510.x.

[284] Peter de Cock, Kauko M  kinen, Eino Honkala, Mare Saag, Elke Kennepohl, Alex Eapen, Erythritol Is More Effective Than Xylitol and Sorbitol in Managing Oral Health Endpoints. *International Journal of Dentistry*. 2016:2016(9868421). doi:10.1155/2016/9868421.

[285] S  derling E, Pienih  kkinen K. Effects of xylitol and erythritol consumption on *mutans streptococci* and the oral microbiota: a systematic review. *Acta Odontologica Scandinavica*. 2020;78(8):599-608, doi:10.1080/00016357.2020.1788721.

[286] Kashket S, Paolino VJ, Lewis DA, van Houte J. In-vitro inhibition of glucosyltransferase from the dental plaque bacterium *Streptococcus mutans* by common beverages and food extracts. *Archives of Oral Biology*. 1985;30(11–12):821-826. doi:10.1016/0003-9969(85)90138-4.

[287] Silhacek KJ, Taake KR. Sodium bicarbonate and hydrogen peroxide: the effect on the growth of *Streptococcus mutans*. *J Dent Hyg*. 2005;79(4):7.

[288] Alison Morrow. NO CAVITIES after YEARS without dentist! || NATURAL DENTAL CARE || Chronic Cavity Cure!. YouTube. 2019. <https://www.youtube.com/watch?v=trvMgLQEnYw>.

- [289] Joseph R Nemeth DDS & Associates. *Fluoride in Our Water* | 2 Alarming New Studies. YouTube. Aug 2019.
<https://www.youtube.com/watch?v=2nizvddHUd0>.
- [290] Valacchi G, Sticozzi C, Belmonte G, et al. Vitamin C Compound Mixtures Prevent Ozone-Induced Oxidative Damage in Human Keratinocytes as Initial Assessment of Pollution Protection. *PLoS One*. 2015;10(8):e0131097. Published 2015 Aug 13.
doi:10.1371/journal.pone.0131097
- [291] Simon V, David K, Anna F, Ulrich S, Andrew W, Nick C, David GA, Flora LHP, Tobias W. The Potential of Fasting and Caloric Restriction to Mitigate Radiation Damage—A Systematic Review. *Frontiers in Nutrition*. 2020;7;183. doi:10.3389/fnut.2020.584543
- [292] Zeraatpishe A, Oryan S, Bagheri MH, et al. Effects of *Melissa officinalis* L. on oxidative status and DNA damage in subjects exposed to long-term low-dose ionizing radiation. *Toxicol Ind Health*. 2011;27(3):205-212. doi:10.1177/0748233710383889
- [293] Yong LC, Petersen MR, Sigurdson AJ, Sampson LA, Ward EM. High dietary antioxidant intakes are associated with decreased chromosome translocation frequency in airline pilots. *Am J Clin Nutr*. 2009;90(5):1402-1410. doi:10.3945/ajcn.2009.28207
- [294] American Dental Association Council on Scientific Affairs. The use of dental radiographs: update and recommendations. *J Am Dent Assoc*. 2006;137(9):1304-1312. doi:10.14219/jada.archive.2006.0393
- [295] Kaźmierczak-Barańska J, Boguszevska K, Adamus-Grabicka A, Karwowski BT. Two Faces of Vitamin C-Antioxidative and Pro-Oxidative Agent. *Nutrients*. 2020;12(5):1501. Published 2020 May 21.
doi:10.3390/nu12051501
- [296] Lee DH, Folsom AR, Harnack L, Halliwell B, Jacobs DR Jr. Does supplemental vitamin C increase cardiovascular disease risk in women with diabetes?. *Am J Clin Nutr*. 2004;80(5):1194-1200.
doi:10.1093/ajcn/80.5.1194
- [297] Jenzsch A, Eick S, Rassoul F, Purschwitz R, Jentsch H. Nutritional intervention in patients with periodontal disease: clinical, immunological and microbiological variables during 12 months. *Br J Nutr*. 2009;101(6):879-85.
- [298] Noor SO, Ridgway K, Scovell L, et al. Ulcerative colitis and irritable bowel patients exhibit distinct abnormalities of the gut microbiota. *BMC*

Gastroenterol. 2010;10:134. Published 2010 Nov 12. doi:10.1186/1471-230X-10-134

[299] Manichanh C, Rigottier-Gois L, Bonnaud E, et al. Reduced diversity of faecal microbiota in Crohn's disease revealed by a metagenomic approach. *Gut*. 2006;55(2):205-211. doi:10.1136/gut.2005.073817

[300] Ikram A, Ke L, Danfeng L, Shah F, Gul HM, Izhar A, Xiaodan H, Ruijun L. Ramadan Fasting Leads to Shifts in Human Gut Microbiota Structured by Dietary Composition. *Frontiers in Microbiology*. 2021;12:314. doi:10.3389/fmicb.2021.642999

[301] Leonel AJ, Alvarez-Leite JL. Butyrate, Current Opinion in Clinical Nutrition and Metabolic Care: September 2012;15(5):474-479 doi: 10.1097/MCO.0b013e32835665fa

[302] McNabney SM, Henagan TM. Short Chain Fatty Acids in the Colon and Peripheral Tissues: A Focus on Butyrate, Colon Cancer, Obesity and Insulin Resistance. *Nutrients*. 2017;9(12):1348. Published 2017 Dec 12. doi:10.3390/nu9121348

[303] Monda V, Villano I, Messina A, et al. Exercise Modifies the Gut Microbiota with Positive Health Effects. *Oxid Med Cell Longev*. 2017;2017:3831972. doi:10.1155/2017/3831972

[304] Kern T, Blond MB, Hansen TH, et al. Structured exercise alters the gut microbiota in humans with overweight and obesity—A randomized controlled trial. *Int J Obes* 2020;44:125–135. doi:10.1038/s41366-019-0440-yf

[305] Selway CA, Mills JG, Weinstein P, Skelly C, Yadav S, Lowe A, Breed MF, Weyrich LS. Transfer of environmental microbes to the skin and respiratory tract of humans after urban green space exposure. *Environment International*. 2020;145(106084) doi:10.1016/j.envint.2020.106084.

[306] Kembel S, Jones E, Kline J, et al. Architectural design influences the diversity and structure of the built environment microbiome. *ISME J*. 2020;6:1469–1479. doi:10.1038/ismej.2011.211

[307] Dill-McFarland KA, Tang ZZ, Kemis JH, et al. Close social relationships correlate with human gut microbiota composition. *Sci Rep*. Jan 2019;9(703). doi:10.1038/s41598-018-37298-9

[308] Smith RP, Easson C, Lyle SM, et al. Gut microbiome diversity is associated with sleep physiology in humans. *PLoS One*.

- 2019;14(10):e0222394. Published 2019 Oct 7.
doi:10.1371/journal.pone.0222394
- [309] Liew WP, Mohd-Redzwan S. Mycotoxin: Its Impact on Gut Health and Microbiota. *Front Cell Infect Microbiol.* 2018;8:60. Published 2018 Feb 26. doi:10.3389/fcimb.2018.00060
- [310] Wastyk HC, Fragiadakis GK, Perelman D, et al. Gut-microbiota-targeted diets modulate human immune status. *Cell.* 2021;184(16):4137-4153.e14. doi:10.1016/j.cell.2021.06.019
- [311] Ruiz-Calderon JF, Cavallin H, Song SJ, et al. Walls talk: Microbial biogeography of homes spanning urbanization. *Sci Adv.* 2016;2(2):e1501061. Published 2016 Feb 12.
doi:10.1126/sciadv.1501061
- [312] Sobko T, Liang S, Cheng WHG, Tun HM. Impact of outdoor nature-related activities on gut microbiota, fecal serotonin, and perceived stress in preschool children: the Play&Grow randomized controlled trial. *Sci Rep.* 2020;10(1):21993. Published 2020 Dec 15. doi:10.1038/s41598-020-78642-2
- [313] Kedia S, Rampal R, Paul J, Ahuja V. Gut microbiome diversity in acute infective and chronic inflammatory gastrointestinal diseases in North India. *J Gastroenterol.* 2016;51(7):660-671. doi:10.1007/s00535-016-1193-1
- [314] Smith KJ, Gavey S, Riddell NE, Kontari P, Victor C. The association between loneliness, social isolation and inflammation: A systematic review and meta-analysis. *Neurosci Biobehav Rev.* 2020;112:519-541. doi:10.1016/j.neubiorev.2020.02.002
- [315] Charnetski CJ, Brennan FX. Sexual Frequency and Salivary Immunoglobulin A (IgA). *Psychological Reports.* 2004;94(3):839-844. doi:10.2466/pr0.94.3.839-844
- [316] Cohen S, Doyle WJ, Skoner DP, Rabin BS, Gwaltney JM Jr. Social ties and susceptibility to the common cold. *JAMA.* 1997;277(24):1940-1944.
- [317] Cohen S, Janicki-Deverts D, Turner RB, Doyle WJ. Does hugging provide stress-buffering social support? A study of susceptibility to upper respiratory infection and illness. *Psychol Sci.* 2015;26(2):135-147. doi:10.1177/0956797614559284
- [318] Aiken TH. The Case Against Television (Should We Have No TVs in our Homes?). *Academia.edu - Independent Researcher.* 2018.

https://www.academia.edu/37957787/The_Case_Against_Television_Should_We_Have_No_TV_s_in_our_Homes_

[319] Madsen KO, Edmonds EJ. Effect of Rice Hulls and Other Seed Hulls on Dental Caries Production in the Cotton Rat. *Journal of Dental Research*. 1962;41(2):405-412. doi:10.1177/00220345620410021201

[320] Hayes C. The Effect of Non-Cariogenic Sweeteners on the Prevention of Dental Caries: A Review of the Evidence. *Journal of Dental Education*. 2001;65:1106-1109. doi:10.1002/j.0022-0337.2001.65.10.tb03457.x

[321] Akamatsu H, Komura J, Asada Y, Niwa Y. Mechanism of anti-inflammatory action of glycyrrhizin: effect on neutrophil functions including reactive oxygen species generation. *Planta Med*. 1991;57(2):119-121. doi:10.1055/s-2006-960045

[322] Wang L, Yang R, Yuan B, Liu Y, Liu C. The antiviral and antimicrobial activities of licorice, a widely-used Chinese herb. *Acta Pharm Sin B*. 2015;5(4):310-315. doi:10.1016/j.apsb.2015.05.005

[323] Peros K, Mestrovic S, Anic-Milosevic S, Rosin-Grget K, Slaj M. Antimicrobial effect of different brushing frequencies with fluoride toothpaste on *Streptococcus mutans* and *Lactobacillus* species in children with fixed orthodontic appliances. *Korean J Orthod*. 2012;42(5):263-269. doi:10.4041/kjod.2012.42.5.263

[324] Herlofson BB, Barkvoll P. The effect of two toothpaste detergents on the frequency of recurrent aphthous ulcers. *Acta Odontol Scand*. 1996 Jun;54(3):150-3.

[325] Salzer S, Rosema NA, Martin EC, Slot DE, Timmer CJ, Dörfer CE, van der Weijden GA. The effectiveness of dentifrices without and with sodium lauryl sulfate on plaque, gingivitis and gingival abrasion--a randomized clinical trial. *Clin Oral Investig*. 2016 Apr;20(3):443-50.

[326] Claus EB, Calvocoressi L, Bondy ML, Schildkraut JM, Wiemels JL, Wrensch M. Dental X-rays and risk of meningioma. *Cancer*. 2012;118(18):4530-4537. doi:10.1002/cncr.26625

[327] Staufenbiel I, Weinspach K, Förster G, Geurtsen W, Günay H. Periodontal conditions in vegetarians: a clinical study. *Eur J Clin Nutr*. 2013;67(8):836-840. doi:10.1038/ejcn.2013.101

[328] Tada A, Miura H. The Relationship between Vitamin C and Periodontal Diseases: A Systematic Review. *Int J Environ Res Public*

Health. 2019;16(14):2472. Published 2019 Jul 11.

doi:10.3390/ijerph16142472

[329] Chan Hee N, Byung Cheol P, Myung Hwa K, Eun Hee C; Seung Phil H. The Efficacy and Safety of 660 nm and 411 to 777 nm Light-Emitting Devices for Treating Wrinkles. *Dermatologic Surgery*. March 2017;43(3):371-380. doi: 10.1097/DSS.0000000000000981

[330] Zerres S, Stahl W. Carotenoids in human skin. *Biochim Biophys Acta Mol Cell Biol Lipids*. 2020;1865(11):158588. doi:10.1016/j.bbalip.2019.158588

[331] Kathleen Hawk. YouTube. Dec 2020.

<https://www.youtube.com/watch?v=yh4NXZFgtlg>

[332] The Wellness Family. YouTube. Mar 2021.

<https://www.youtube.com/watch?v=9Fa4UyaT-8o>

[333] Badet C, Richard B, Castaing-Debat M, de Flaujac PM, Dorignac G. Adaptation of salivary *Lactobacillus* strains to xylitol. *Arch Oral Biol*. 2004;49(2):161-164. doi:10.1016/s0003-9969(03)00200-0

[334] Rodklongtan A, Chitprasert P. Combined effects of holy basil essential oil and inlet temperature on lipid peroxidation and survival of *Lactobacillus reuteri* KUB-AC5 during spray drying. *Food Res Int*. 2017;100(Pt 1):276-283. doi:10.1016/j.foodres.2017.07.016

[335] Garg S, Sadr A, Chan D. Potassium Iodide Reversal of Silver Diamine Fluoride Staining: A Case Report. *Oper Dent*. 2019;44(3):221-226. doi:10.2341/17-266-S

[336] Olofsson T, Vásquez A. Chapter 14 - Honeybee-Specific *Bifidobacteria* and *Lactobacilli*. Academic Press. 2018;235-241. doi:10.1016/B978-0-12-805060-6.00014-4.

[337] Aween MM, Hassan Z, Muhialdin BJ, Eljamel YA, Al-Mabrok AS, Lani MN. Antibacterial activity of *Lactobacillus acidophilus* strains isolated from honey marketed in Malaysia against selected multiple antibiotic resistant (MAR) Gram-positive bacteria. *J Food Sci*. 2012;77(7):M364-M371. doi:10.1111/j.1750-3841.2012.02776.x

[338] Saelao P, Borba RS, Ricigliano V, Spivak M, Simone-Finstrom M. Honeybee microbiome is stabilized in the presence of propolis. *Biol Lett*. 2020;16(5):20200003. doi:10.1098/rsbl.2020.0003

[339] Khurshid Z, Naseem M, Zafar MS, Najeeb S, Zohaib S. Propolis: A natural biomaterial for dental and oral healthcare. *J Dent Res Dent Clin Dent Prospects*. 2017;11(4):265-274. doi:10.15171/joddd.2017.046

- [340] Kshirsagar MM, Dodamani AS, Karibasappa GN, et al. Antibacterial activity of garlic extract on cariogenic bacteria: An in vitro study. *Ayu*. 2018;39(3):165-168. doi:10.4103/ayu.AYU_193_16
- [341] Smith SI, Aweh AJ, Coker AO, Savage KO, Abosede DA, Oyedeji KS. Lactobacilli in human dental caries and saliva. *Microbios*. 2001;105(411):77-85.
- [342] Nadelman P, Magno MB, Masterson D, da Cruz AG, Maia LC. Are dairy products containing probiotics beneficial for oral health? A systematic review and meta-analysis. *Clin Oral Investig*. 2018;22(8):2763-2785. doi:10.1007/s00784-018-2682-9
- [343] Villavicencio J, Villegas LM, Arango MC, Arias S, Triana F. Effects of a food enriched with probiotics on *Streptococcus mutans* and *Lactobacillus* spp. salivary counts in preschool children: a cluster randomized trial. *J Appl Oral Sci*. 2018;26:e20170318. Published 2018 May 14. doi:10.1590/1678-7757-2017-0318
- [344] Caufield PW, Schön CN, Saraithong P, Li Y, Argimón S. Oral Lactobacilli and Dental Caries: A Model for Niche Adaptation in Humans. *J Dent Res*. 2015;94(9 Suppl):110S-8S. Doi:10.1177/0022034515576052
- [345] Khurshid Z, Naseem M, Zafar MS, Najeeb S, Zohaib S. Propolis: A natural biomaterial for dental and oral healthcare. *J Dent Res Dent Clin Dent Prospects*. 2017;11(4):265-274. doi:10.15171/jodddd.2017.046
- [346] Mohan PV, Uloopi KS, Vinay C, Rao RC. In vivo comparison of cavity disinfection efficacy with APF gel, Propolis, Diode Laser, and 2% chlorhexidine in primary teeth. *Contemp Clin Dent*. 2016;7(1):45-50. doi:10.4103/0976-237X.177110
- [347] Eija Könönen. Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases, 248, 2977-2984.e3. Chapter: Anaerobic Cocci and Anaerobic Gram-Positive Nonsporulating Bacilli.
- [348] S. S. Ahirwar, M. K. Gupta 2 and S K. Snehi. DENTAL CARIES AND LACTOBACILLUS: ROLE AND ECOLOGY IN THE ORAL CAVITY. *Inter J of PHarmaceutical Sciences and Research*. 019; Vol. 10(11): 4818-4829. doi:10.13040/IJPSR.0975-8232.10(11).4818-29.
- [349] Bizhang M, Kaleta-Kragt S, Singh-Hüsgen P, Altenburger MJ, Zimmer S. Effect of 10% fluoride on the remineralization of dentin in situ. *J Appl Oral Sci*. 2015;23(6):562-570. doi:10.1590/1678-775720150239
- [350] Banting DW, Papas A, Clark DC, Proskin HM, Schultz M, Perry R. The effectiveness of 10% chlorhexidine varnish treatment on dental

- caries incidence in adults with dry mouth. Gerodontology. 2000;17(2):67-76. doi:10.1111/j.1741-2358.2000.00067.x*
- [351] Papas AS, Vollmer WM, Gullion CM, et al. Efficacy of chlorhexidine varnish for the prevention of adult caries: a randomized trial. *J Dent Res. 2012;91(2):150-155. doi:10.1177/0022034511424154*
- [352] Smith SI, Aweh AJ, Coker AO, Savage KO, Abosede DA, Oyedele KS. *Lactobacilli in human dental caries and saliva. Microbios. 2001;105(411):77-85.*
- [353] Mattarelli P. *The Bifidobacteria and Related Organisms. 2018. Academic Press. Related Genera Within the Family Bifidobacteriaceae. 3.4.7.1.1 Additional Information. doi:10.1016/C2015-0-02462-5*
- [354] Beighton D, Al-Haboubi M, Mantzourani M, et al. Oral *Bifidobacteria: caries-associated bacteria in older adults. J Dent Res. 2010;89(9):970-974. doi:10.1177/0022034510369319*

